Draft Environmental Impact Statement

Cross Cascade Pipeline

September 1998

Lead Agencies:

U.S.D.A. Forest Service
Washington State Energy Facility Site Evaluation Council

Prepared in compliance with
the National Environmental Policy Act (NEPA)
and the Washington State Environmental Policy Act (SEPA)

September 1998

Dear Reviewer:

Enclosed for your review is the Draft Environmental Impact Statement (DEIS) for the proposed Cross Cascade Pipeline Project. The proponent, Olympic Pipe Line Company, has requested a right-of-way through National Forest land and lands managed by other state and federal agencies on a route between Snohomish County and the City of Pasco, Washington.

The Forest Service and the Energy Facility Site Evaluation Council have completed this DEIS under contract with Jones & Stokes Associates, Inc. The analysis was undertaken to meet the direction of the National Environmental Policy Act (NEPA) and other relevant federal laws and regulations as they pertain to fuel pipeline easement requests on federal lands and the Washington State Environmental Policy Act (SEPA) for state and private lands.

Based on comments received during the scoping phase of this project, issues were identified. A No Action and Action Alternative, and alternative components, including mitigation measures, are discussed in detail in the DEIS.

To ensure a complete analysis, we are asking you to help by reviewing this DEIS and providing comments. The comment period for this document closes on December 17, 1998. We have scheduled four public meetings to discuss the DEIS. The public meetings will be as follows:

November 12, 1998 - 4 to 8 pm
Jackson High School Cafeteria
1508 - 136th Street SE
Mill Creek, WA 98012

November 10, 1998 - 4 to 8 pm
Mt. Si Senior Center
411 Main Avenue S
North Bend, WA 98045

November 17, 1998 - 4 to 8 pm
Hal Holmes Conference Center
201 N. Ruby Street
Ellensburg, WA 98926

November 18, 1998 - 4 to 8 pm
Columbia Basin College, Workforce Training Center
2600 N. 20th Avenue
Pasco, WA 99301

Please send your comments to either: Floyd J. Rogalski, Olympic Pipeline Team Leader, Cle Elum Ranger District, 803 West Second Street, Cle Elum, WA 98922, or to Allen Fiksdal, Manager, Energy Facility Site Evaluation Council, P.O. Box 43172, Olympia, WA 98504-3172. Comments on this document must be postmarked by **December 17, 1998.**

For further information regarding this proposal, you may also contact Floyd Rogalski at (509)674-4411 or Allen Fiksdal at (360)956-2152. For copies of the DEIS, please contact Allen Fiksdal or you may access it on the Internet at www.efsec.wa.gov.

Please Note: Comments received in response to this solicitation, including names and addresses of those who comment, will be considered part of the public record on this proposed action and will be

available for public inspection. Comments submitted anonymously will be accepted and considered; however, those who submit anonymous comments will not have standing to appeal the subsequent decision under 36 CFR Parts 215 or 217. Additionally, pursuant to 7 CFR 1.27(d), any person may request the agency to withhold a submission from the public record by showing how the Freedom of Information Act (FOIA) permits such confidentiality. Persons requesting such confidentiality should be aware that, under the FOIA, confidentiality may be granted in only very limited circumstances, such as to protect trade secrets. The Forest Service will inform the requester of the agency's decision regarding the request for confidentiality, and where the request is denied, the agency will return the submission and notify the requester that the comments may be resubmitted with or without name and address within 14 days.

Please remember, for a comment to be considered to have substance, it needs to:

1. Provide new information pertaining to the proposed action or an alternative;

2. Identify a new issue or expand upon an existing issue;

3. Identify a different way to meet the underlying need;

4. Provide an opinion regarding an alternative, **including the basis or rationale for the opinion;**

5. Point out a specific flaw in the analysis; or

6. Identify a different source of credible research which, if used in the analysis, could result in different effects.

Note to Reviewers: Reviewers should provide the Forest Service and EFSEC with their comments during the review period of the Draft Environmental Impact Statement. This will enable the lead agencies to analyze and respond to the comments at one time and to use information acquired in the preparation of the Final Environmental Impact Statement, thus avoiding undue delay in the decision making process. Reviewers have an obligation to structure their participation in the National Environmental Policy Act process so that it is meaningful and alerts the agency to the reviewers' position and contentions. Vermont Yankee Nuclear Power Corp. v. NRDC, 435 U.S. 519, 553 (1978). Environmental objections that could have been raised at the draft stage may be waived if not raised until after completion of the Final Environmental Impact Statement. City of Angoon v. Hodel (9th Circuit, 1986) and Wisconsin Heritages, Inc. V. Harris, 490 F. Supp. 1334, 1338 (E.D. Wis. 1980). Comments on the Draft Environmental Impact Statement should be specific and should address the adequacy of the statement and the merits of the alternatives discussed (40 CFR 1503.3).

Allen Fiksdal
Energy Facility Site Evaluation Council

Floyd Rogalski
USDA Forest Service

Draft Environmental Impact Statement
Olympic Cross Cascade Pipeline Project
September 1998

Lead Agencies:
USDA Forest Service
State of Washington
Washington Energy Facility Site Evaluation Council

Cooperating Agencies:
US Department of the Interior
Bureau of Land Management
US Fish and Wildlife Service

US Department of Defense
US Army Corps of Engineers
US Army - Fort Lewis

Responsible Officials:
Joseph K. Buesing, District Manager
Spokane District Office
Bureau of Land Management
Spokane, WA

Allen Fiksdal
Washington Energy Facility
Site Evaluation Council
Olympia, WA

Abstract: The Olympic Pipe Line Company proposes to construct and operate a common carrier petroleum products pipeline from Snohomish County to the city of Pasco, Washington. The project is proposed as a response to growing demands for refined petroleum products in eastern Washington from refineries in western Washington and would replace the existing system of barging and trucking the same petroleum products to central and eastern Washington. The approximately 230-mile line would include up to six pump stations and a products terminal adjacent to I-90 near the town of Kittitas. Construction of the line would take at least one year and would take longer if construction windows are required to reduce impacts to fish and wildlife.

The project as proposed responds to requests from shippers for a less expensive and more direct means to transport refined petroleum product from western Washington to central and eastern Washington. Major environmental concerns include construction impacts at stream and river crossings and across approximately 17.1 acres of wetlands; risks to surface and groundwater as a result of construction or of a spill; spill risks from the pipeline during operation of the line; spill risks from trucking and barging if the line is not built; use of public lands and the impacts and precluded uses thereof; and potential effects on threatened and endangered species during construction and operation.

Location of Proposal:
The proposal is located in the following cities and counties:

Snohomish County	
King County	City of North Bend, City of Snoqualmie
Kittitas County	City of Kittitas
Adams County	
Grant County	
Franklin County	City of Pasco

Date Comments Are to be Received: December 17, 1998

Where to Submit Comments: Comments may be submitted to Allen Fiksdal or Floyd Rogalski at the addresses listed below:

Allen Fiksdal
Washington Energy Facility
Site Evaluation Council
P.O. Box 43172
Olympia, WA 98504
(360) 956-2152

Floyd Rogalski
USDA Forest Service
Wenatchee National Forest
Cle Elum Ranger District
803 W. Second
Cle Elum, WA 98922
(509) 674-4411 Ext. 315

For Further Information Contact: Allen Fiksdal or Floyd Rogalski at the addresses above.

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Reader's Guide to EIS Conventions

To assist readers in reviewing this environmental impact statement (EIS), this reader's guide explains the conventions that are used for units of measurement and for discussing locations along the proposed pipeline corridor.

- **Metric/English Units of Measure:** To comply with current requirements for units of measure in EISs, this document presents measurements first in metric units, followed by the English equivalent in parentheses. Abbreviations for units are explained in the List of Acronyms and Abbreviations.

- **Mileposts and Segment Numbers Along Pipeline Corridor:** The pipeline corridor is generally described from west (near Woodinville in western Washington) to east (near Pasco in eastern Washington). Mileposts, corridor segment numbers, and landmarks are used as appropriate throughout the EIS. Precise milepost designations can change slightly as a result of alignment changes during the permitting process.

This document includes several additional tools to help the reader at the end of this volume:

- Glossary of technical terms
- List of Acronyms and Abbreviations
- List of references used in preparing this EIS
- Detailed strip maps of the pipeline corridor, in the EIS Map Supplement

Summary

Olympic Pipe Line Company (OPL), a petroleum pipeline company located in Renton, Washington, is proposing to construct and operate a new refined petroleum products pipeline in Washington. The new buried pipeline would have an initial capacity of 60,000 barrels (bbls) or 2,520,000 gallons per day, with three pump stations operating. Up to three additional stations would come online as demand increased to an ultimate capacity of up to 110,000 bbls (4,620,000 gallons) per day.

The proposed pipeline is approximately 370 kilometers (km) (230 miles) long and would be an extension of the existing 644 km (400-mile) OPL pipeline system. The proposed pipeline would begin near Woodinville in western Washington and terminate at an existing storage and distribution facility in Pasco in eastern Washington (Figure S-1). A storage and distribution facility would be constructed at Kittitas, near Ellensburg.

As part of the Washington Energy Facility Site Evaluation Council's (EFSEC) permitting process, OPL submitted an Application for Site Certification (ASC) on February 5, 1996 and an amended ASC in May 1998. The ASC was reviewed by an independent environmental consultant (Jones & Stokes Associates) on behalf of EFSEC and the U.S. Forest Service (USFS). Additional information was requested from OPL to more completely analyze impacts and to address (avoid or mitigate) potential impacts of the originally proposed project. During this process, OPL made numerous changes in the project to respond to consultant comments and to agency concerns to reduce impacts. Several iterations of field studies, data collection, and analyses by OPL, and review by the consultant, occurred over the course of reviewing the project and the ASC. In addition, the consultant collected and analyzed additional information needed to support the impact analyses in the Draft Environmental Impact Statement (EIS). As a result, the EIS evaluates the potential impacts of the revised proposed project, as relocated, reconfigured, and avoided/mitigated by OPL.

OPL currently transports refined petroleum products for shippers in Washington from four northwest refineries (Tosco, Arco, Texaco, Shell) to various customers in Washington and Oregon via OPL's pipeline from the refineries south to Portland. OPL is a petroleum products carrier. Its primary mission is to carry product from these four refineries.

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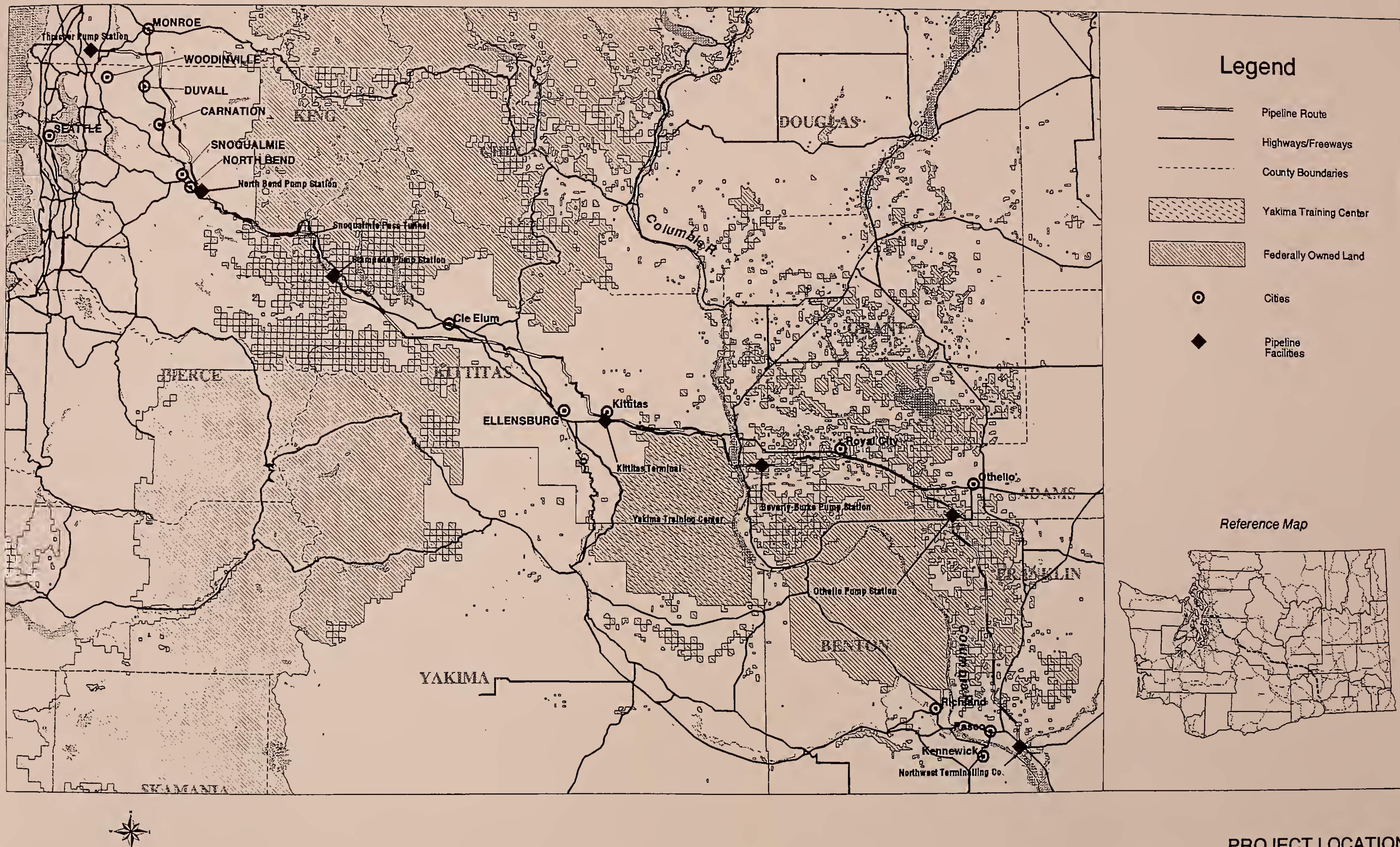
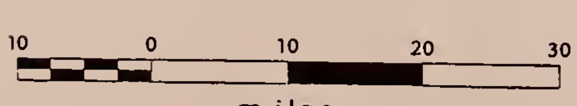




PROJECT LOCATION

Cross Cascade Pipeline
Washington
FIGURE S-1

AGENCY ROLES AND DECISIONS TO BE MADE

Numerous agencies are involved in EIS preparation, consultation, and permitting decisions for the pipeline project, as shown in Table S-1.

Table S-1. Overview of Permit, Approval, and Consultation Requirements for the Proposed Pipeline Project

Agency	Permit/Authority
Federal Government	
Advisory Council for Historic Preservation	Consultation under Section 106/ *National Historic Preservation Act*
U.S. Army Corps of Engineers (ACOE)	Cooperating agency
	Section 404(b)(1) Individual Permit/ *Clean Water Act*
	Section 10 Permit/ *Rivers and Harbors Act of 1899*
U.S. Department of the Interior, Bureau of Land Management (BLM)	Record of Decision (ROD)/ *Minerals Leasing Act: Title I, Section 28 (c)(2) of the Mineral Leasing Act of 1920, as amended, November 16, 1973 authorizes the Secretary of the Interior to grant or renew rights-of-way (ROW) or permits and to enter into agreements with other land-managing federal agencies for the processing of applications for pipelines to transport oil, natural gas, synthetic liquid or gaseous fuels, or refined products produced therefrom.*
	Right-of-Way (ROW) Grant/ *Minerals Leasing Act*
	Temporary Use Permit/ *Minerals Leasing Act*
	Notice to Proceed
	Antiquities and Cultural Resources Use Permit
	Consultation
U.S. Department of the Interior, Bureau of Reclamation (USBR)	Cooperating agency
	Consultation and concurrence
U.S. Department of Defense (DOD), U.S. Army	Cooperating agency
	Consultation and concurrence
U.S. Department of the Interior, Fish and Wildlife Service (USFWS)	Cooperating agency
	Consultation and concurrence
	Section 7 and 10 Biological Opinion/ *Endangered Species Act*

Continued

Table S-1. Overview of Permit, Approval, and Consultation Requirements for the Proposed Pipeline Project

Agency	Permit/Authority
U.S. Department of Agriculture, Forest Service (USFS)	Co-lead agency
	Consultation and concurrence
State Government	
State of Washington, Energy Facility Site Evaluation Council (EFSEC)	Co-Lead Agency and Site Certification Agreement/ *EFSEC's responsibilities derive from the Revised Code of Washington (RCW) 80.50, and include siting large natural gas and oil pipelines, electric power plants above 250 megawatts and their dedicated transmission lines, new oil refineries or large expansions of existing facilities, and underground natural gas storage fields. EFSEC has been delegated authority by the U.S. Environmental Protection Agency to issue permits under the Federal Water Pollution Control Act and the Federal Clean Air Act for facilities under its jurisdiction.*
	Section 309/ *Clean Air Act*
	National Pollutant Discharge Elimination System (NPDES) Permits
Washington State Parks and Recreation Commission (WSPRC)	Easements
Washington State Department of Natural Resources (DNR)	Easements
All Landowners Along the Pipeline ROW	
Federal agencies (through BLM approval process and NEPA); state and local agencies; private landowners	ROW ownership agreements
Grant County P.U.D.	ROW and permit to cross Columbia River on Wanapum Dam

Of these agencies, the Bureau of Land Management and EFSEC play key roles in issuing "umbrella" authorizations that incorporate the input of other agencies, while EFSEC and the U.S. Forest Service have served as Lead Agencies in preparing the EIS. The roles of these three agencies are highlighted below:

- **Bureau of Land Management.** The Mineral Leasing Act (MLA) was amended, in part (87 Stat. 576 and ff.), to provide efficiencies in granting MLA rights-of-way (ROW) across federal lands managed by multiple agencies by providing applicants the convenience of one application process and one authorization document. The Secretary of the Interior, through the BLM, is mandated to process MLA applications across federal lands managed by more than one agency with the prior consent of each agency head (the exact wording can be found at 87 Stat. 577 [sec.9(c)(2) of Act of Nov. 16, 1973 {P.L. 93-153}]). The regulations at 43 CFR 2880.0-7(a) reflect this statutory mandate. BLM, in accordance with the Act, will not issue a ROW across

federal lands without the consent of the respective agency heads. This consent will be required before the BLM will issue a Record Of Decision (ROD). The BLM will request consents, in writing, from the agency heads. Assuming a ROD is affirmative, BLM will then issue one authorization (ROW grant) under the MLA for use of all federal lands. No additional authorization documents are required from other affected federal land managing agencies under the MLA. Subsequently, Notice(s) To Proceed will be issued as appropriate.

- **Washington State Energy Facility Site Evaluation Council.** EFSEC coordinates all of the evaluation and licensing steps for siting major energy facilities in Washington. If a project is approved, EFSEC specifies the conditions of construction and operation, issues a Site Certification Agreement in lieu of any other individual state or local agency authority, and manages the environmental and safety oversight program of project operations. As part of EFSEC's permitting process, OPL submitted an Application for Site Certification on February 5, 1996 and an amended application in May 1998. EFSEC is also a co-lead agency with the U.S. Forest Service in preparing the EIS. EFSEC is the sole agency authorized to permit the project. Other agency landowners who otherwise do not have permit authority have full ROW authority over their lands.

- **U.S. Forest Service.** The Department of Agriculture, U.S. Forest Service is the lead agency with EFSEC for developing the EIS. The Bureau of Reclamation, Department of the Army, U.S. Fish and Wildlife Service, and U.S. Army Corps of Engineers are cooperating agencies in the development of the EIS and will issue separate agency consents before the BLM issues a ROD for the ROW application.

NEED FOR ACTION

As central and eastern Washington continue to grow, more petroleum products are required. Although historically petroleum products have been delivered to these areas from a combination of California refineries, Rocky Mountain refineries (via the Yellowstone and Chevron pipelines), and northwest Washington refineries, the market trend is toward meeting the increases in demand with product from northwest Washington refineries.

Product from northwest Washington refineries can end up anywhere in the state but is largely distributed within western Washington, eastern Washington in the Tri-Cities area, and central Washington near Ellensburg. The primary mechanisms of transport are:

- the north-south pipeline serving western Washington and Oregon customers from Seattle to Portland;

- trucks from Harbor Island in Seattle and directly from refineries crossing the Cascades via Snoqualmie and Stevens Passes to central Washington and the Moses Lake and Ellensburg areas; and

- barges on the Columbia River which pick up product from the pipeline in Portland and carry it to Pasco, Umatilla, and Clarkston.

OPL responded to increased demand on their pipeline system from shippers in western, central, and eastern Washington by adding pumping equipment, using flow-improving polymers, and adding motor horsepower to add capacity to the north-south pipeline to Vancouver and Portland. However, these measures alone failed to keep pace with the demand on the existing system. Although OPL was able to increase transportation of product through the line to maximum capacity, shippers were forced to use increasing numbers of tanker trucks and barges to obtain needed product. As a result, eastern and western Washington shippers were curtailed and had to order product via other means. Under such conditions, common carrier pipelines are referred to as “oversubscribed” and pipeline owners are required to “prorate” the volumes they carry, so the shortage is allocated equally to all shippers.

Even though the north-south pipeline reached capacity in 1995, shippers have continued to order product from Washington refineries, even when the preferred delivery system (the north-south pipeline) was at capacity and alternate systems of delivery (truck and barge) were required.

With expected continued population and commerce growth in western, central, and eastern Washington, and demand on the OPL system from all three areas, OPL believes that the demand for the transport of products in their system, including products delivered to central and eastern Washington from western Washington refineries, will continue to increase about 1.5 percent annually. As the amount of proration continues to increase, shippers will be required to increase their use of multiple sources and modes of shipment to meet increasing demands for refined product. This demand has created a request by shippers for a more price-competitive means of delivery of refined petroleum products from western Washington refineries. Shippers have asked OPL to examine whether a new pipeline could transport product to eastern and central Washington at a lower cost than the current barge and truck system. The proposed project, then, is primarily offered as a solution to shippers’ request for a lower cost, more efficient, west-to-east delivery system, which would replace barges and trucks. Enough qualified shippers have signed letters of interest with OPL to fill half the proposed line at this time.

PURPOSE OF THE PROJECT

The purpose of the Proposed Action is to respond to a need to provide a cost-effective, efficient, environmentally sound means to transport refined petroleum products from western Washington refineries to central and eastern Washington to meet the long-range needs for product transportation. The applicant’s proposal is to build a west-to-east pipeline to achieve that purpose.

ALTERNATIVES ANALYZED IN THE EIS

Proposed Action: Petroleum Product Pipeline

The proposed pipeline responds to the above-stated Purpose and Need by transporting petroleum products from refineries in Anacortes and Whatcom County to central and eastern Washington at a lower cost than other alternatives. It would avoid the need to offload the product from the existing pipeline onto tanker trucks and river barges, or from ocean barges onto river barges, or from Puget Sound barges onto trucks via Harbor Island. Conversion from one mode of shipment to another is not as efficient as a single mode (i.e., the pipeline). Also, construction of a new pipeline would be more efficient for those who can pick up petroleum product in Kittitas, rather than trucking it from Seattle across Snoqualmie or Stevens Passes.

The proposal would reduce the risk of accidental spills during the transfer from one mode of shipment to another, from barges on the Columbia River, and in Puget Sound, and from tanker trucks along the I-90 and U.S. Highway 2 corridors. The proposal would create a risk of spill along the pipeline corridor which does not now exist in these areas, and 29 percent of the line would require creation of a new utility corridor.

The proposed Cross Cascade Pipeline would originate on OPL's existing north/south lines just north of the King-Snohomish county line, extend east crossing Snoqualmie Pass into Kittitas County generally following the same direction as the I-90 corridor, cross the Columbia River in Grant County, and terminate at the Northwest Terminalling Company's existing terminal in Pasco, Washington. The pipeline would cross parts of about 78 wetlands and approximately 300 streamcourses and irrigation canals. The coated steel pipeline would be 35.6 centimeters (14 inches) in diameter from the Thrasher Station to the Kittitas Terminal and 30.5 centimeters (12 inches) in diameter from the Kittitas Terminal to the Northwest Terminalling bulk storage facility in Pasco.

Columbia River Approach Options

OPL and the EIS evaluated three route segment options for the pipeline:

- through the Yakima Training Center (YTC);
- inside the north property/fence line of the YTC (closer to I-90); and
- north of I-90 through Ginkgo Petrified Forest State Park.

OPL's preferred alternative is the northern route through Ginkgo State Park. The YTC options are likely to conflict with Army training activities. Impacts of the approach options are summarized in Table S-2.

Table S-2. Evaluation of Constructing the Columbia River Approach Options

Resource Area	Ginkgo State Park Option	Yakima Training Center Options
Geology, Soils, and Seismicity	Localized disruption of Ginkgo Petrified Forest State Park, a nationally significant fossilized forest, and damage to fossils. Pipeline would pass through a 1.5-mile-wide landslide east of the park.	Neither YTC option would pass through or disrupt Ginkgo State Park, and YTC options would avoid the landslide east of the park.
Botanical Resources	Fewer impacts than YTC options to shrub-steppe vegetation, hay/pasture, and grass/forb communities and no impacts to sensitive plant species.	Each of the YTC options would affect about 9.5 acres more of shrub-steppe vegetation, 3.9 acres more of hay/pasture, and 3.3 acres more of grass/forb communities than the Gingko option. The southern YTC option would affect sensitive plant species, two populations of Hoover's tauschia.
Wetlands	This option would have the same wetland impacts as the fenceline YTC option.	For the fenceline YTC option, two scrub-shrub wetlands would be avoided. The southern YTC option would affect 0.08 acre more wetlands than the Ginkgo or fenceline YTC options, affecting two scrub-shrub wetlands (Category II and Category III).
Wildlife and T&E Species	Pipeline would be located within 591 feet of a Swainson's hawk nest, and other nests may be present. Timing restrictions might be required to avoid impacts to mule deer winter range located adjacent to Ginkgo State Park.	For the fenceline YTC option, burrowing owl and striped whipsnake are known to be in the vicinity but impacts would be minor. The southern YTC option does not cross priority habitat and impacts would be minor, although concerns for sensitive species would exist.
Water	Negligible or minor water quality impacts. Streams are intermittent and construction would occur when they were dry.	Both YTC options would have negligible or minor water quality and stream impacts, similar to the Ginkgo option.
Fisheries	No significant fisheries resources exist with this option.	As with the Gingko option, no significant fisheries resources exist for either YTC option.
Air Quality	No air quality impacts would occur with this option.	As with the Gingko option, no air quality impacts would occur for either YTC option.
Noise	No noise impacts would occur with this option.	As with the Gingko option, no noise impacts would occur for either YTC option.
Traffic and Transportation	No traffic or transportation impacts would occur with this option.	As with the Gingko option, no traffic or transportation impacts would occur for either YTC option.

Continued

Table S-2. Evaluation of Constructing the Columbia River Approach Options

Resource Area	Ginkgo State Park Option	Yakima Training Center Options
Cultural and Historical Resources	Avoidance of resources may be difficult because surveys found prehistoric sites covering large areas.	A survey of the YTC options was not completed.
Land and Shoreline Use	Minor impacts on land use would include increased noise, dust, and traffic; inconvenient access; and temporary disturbance to the rural and open space character.	For both YTC options, minor to moderate impacts would occur to the YTC from destabilized soils, which could then cause heavy vehicles (i.e., tanks) to sink when they "dig in and spin." The realistic nature of training exercises would be compromised during construction. Both options would require close coordination with the YTC to avoid conflicts and limit future training activities over destabilized soils.
Agriculture	No croplands or irrigation facilities exist on the State Park, and thus agriculture would not be affected.	As with the Gingko option, no croplands or irrigation facilities would be crossed or affected by either YTC option.
Recreation	The Ginkgo Petrified Forest State Park, including Wanapum Campground, would be crossed. Recreationists would experience major impacts from dust, noise, and views. Construction vehicles would increase traffic congestion. Construction during active use, from May through September, would be most disruptive to overall recreational experiences.	Neither YTC option would pass through or disrupt Ginkgo State Park and, therefore, no recreational impacts would occur.
Visual Quality and Aesthetics	This option would be located out of view of I-90 viewers.	For the fenceline YTC option, from MP 127.2 to 129.2, the pipeline would follow I-90 and travelers would see slope scarring when the route turns southeast and traverses up a slope between MP 129.2 and 130.2. It would also be visible from Hunzinger Road. For the southern YTC option, the corridor would be visible to personnel on the YTC and recreationists as it passes near Getty's Cove private campground near MP 144.7, passes adjacent to Wanapum Dam, and traverses down a steep slope to the Columbia River.
Socioeconomics	No socioeconomic impacts would occur with this option.	As with the Gingko option, no socioeconomic impacts would occur for either YTC option.
Public Services and Utilities	No public service and utilities impacts would occur with this option.	As with the Gingko option, no public service and utilities impacts would occur for either YTC option.
Health and Safety	No health and safety impacts would occur with this option.	As with the Gingko option, no health and safety impacts would occur for either YTC option.

Options for Crossing Columbia River

OPL and the EIS also evaluated options for crossing the Columbia River. The five options and costs include:

- dredging north of the I-90 Bridge ($10 million);
- crossing the I-90 Bridge ($6.9 million);
- horizontal directional drilling downstream (south) of Wanapum Dam ($7.8 million);
- crossing the Burlington Northern Beverly Railroad Bridge ($7.6 million); and
- crossing on Wanapum Dam ($6.9 million).

OPL's preferred route is the directional drilled crossing downstream of Wanapum Dam. Environmental impacts of the five options are summarized in Table S-3.

Table S-3. Columbia River Crossing Options Evaluated in the EIS

Location	Geotechnical Feasibility	Environmental Impacts	Estimated Cost[1]
Dredging north of I-90 Bridge	gravel - feasible	need to minimize impacts to fish habitat and shorelines	$10.0 million
Crossing on I-90 Bridge	structurally feasible	none	$6.9million
Crossing on Wanapum Dam	structurally feasible	none	$6.9 million
Drilling south of Wanapum Dam	gravel - feasible	need large cleared area for drilling base	$7.8 million
Crossing on Beverly Railroad Bridge	structurally feasible	none	$7.6 million

[1] All costs are based on routes beginning at Stevens Road east of Kittitas Terminal and ending at the Beverly-Burke Pump Station.

Source: OPL Application for Site Certification 1998.

Pump Stations

Six pump stations would be located along the route, including the Thrasher Station in south-central Snohomish County, the North Bend Station located south of SE 120th Street and south of the Cedar Falls Trail, the Stampede Station near Stampede Pass Road and east of Lake Easton, the Kittitas Station located at the Kittitas Terminal at the intersection of I-90 and Badger Pocket Road, the Beverly-Burke Station located in Grant County about 6.4 km (4 miles) east of the Columbia River, and the Othello Station located about 9.7 km (6 miles) southwest of Othello and north of State

Route 24 in Adams County. Three of these stations (Thrasher, North Bend, and Kittitas) would be initially constructed. The others would be constructed over time as a response to increased demand.

The Thrasher Pump Station would be located on about 1.5 hectares (ha) (3.7 acres) and each of the other pump station sites would be about 0.4 to 0.8 ha (1 to 2 acres) in size. Part of each site would be cleared. The Thrasher, North Bend, and Stampede Pump Stations would be enclosed in a building to protect the facility and provide noise abatement. The stations would be fenced and gated to limit access.

Block Valves

An estimated 29 block valves would be installed along the pipeline corridor. These valves would be remotely controlled from the pipeline control center and can also be manually operated as they are on the surface. They would enable an automatic response to any detected rupture or hole in the pipeline and would limit the amount of product released. Each block valve site would be a fenced area of approximately 9.1 by 12.2 m (30 by 40 feet).

Kittitas Terminal

A storage terminal would be built near the City of Kittitas. The Kittitas Terminal would occupy about 10.9 ha (27 acres) immediately north of I-90 and east of Badger Pocket Road. The terminal would ultimately have nine aboveground liquid petroleum storage tanks, with a total storage capacity of 36,120,000 gallons of product. In addition, one 420,000 gallon transmix/relief tank would also be included. The terminal also includes truck loading racks and parking for tanker trucks.

Pasco Delivery Facility

The Pasco Delivery Facility would occupy about 0.4 ha (0.9 acre) near the intersection of U.S. Highway 12 on Sacajawea Park Road, across the road from the Northwest Terminalling Facility in Pasco. The site is level with minimal vegetation and is now unused. The facility would have metering equipment, a sample building, a control building, and other equipment. Two lines would connect to the Northwest Terminalling Facility, one for diesel fuel and one for gasoline.

Right-of-Way

Approximately 176.2 km (109 miles) or 47 percent of the pipeline corridor would be located within existing cleared ROW. About 90.1 km (56 miles) or 24 percent would be located immediately adjacent to existing cleared corridors. These areas are primarily roadways where existing utilities or roadway construction precluded placing the pipeline within the existing ROW. About 106.2 km (66 miles) or 29 percent would be located in new corridors.

Of the 370 km (230 miles) of pipeline, approximately 40.3 km (25 miles) of pipeline ROW are owned by federal agencies, 48.3 km (30 miles) of ROW are owned by state agencies, and King County owns approximately 3.2 km (2 miles). The majority of federal ownership along the proposed route is within lands managed by the U.S. Forest Service and the Bureau of Reclamation. The remaining 280.1 km (174 miles) of ROW are privately owned. The proposed pipeline would utilize two trail systems, the Cedar Falls Trail managed by King County and the John Wayne Trail owned by Washington State Parks.

Construction

Construction of the pipeline would take about 1 year and cost slightly more than $105 million. The anticipated duration of pipeline construction at any one location along the corridor would be no more than 10 days except for larger water crossings where more time is needed. Construction progress would be slowest at road and waterway crossings, where several days may be required to complete the crossing by either boring or trenching. Construction progress in flat open terrain might be completed in as little as 2 to 3 days.

OPL proposes to have construction occur in three spreads, and a variety of crews within those spreads, to enable construction to occur concurrently at various places along the pipeline.

Spread 1 is generally comprised of the western portion of the pipeline and includes Snohomish County, northeastern King County, and the central portion of Kittitas County. It would require a peak construction workforce of 375. Under favorable weather conditions, construction would occur at a rate of 3.1 to 3.7 km (1.9 to 2.3 miles) per day and would take a total of about 1.75 months.

Spread 2, which is generally the central portion, is comprised of the mountainous segment of the pipeline, buried within the Snoqualmie Pass Tunnel over Snoqualmie Pass, as well as major river crossings. It includes eastern King County and western Kittitas County. It would require a peak workforce of 159 workers and would be constructed at a rate of 0.6 km (0.4 mile) per day for a total of 4.33 months.

Spread 3, the eastern portion of the pipeline, includes eastern Kittitas County, Grant County, Adams County, and Franklin County. It would require 375 workers during the peak and would be constructed at a rate of 3.1 to 3.7 km (1.9 to 2.3 miles) per day for a total of about 2 months.

The construction time frame on any spread would exceed these schedules if certain construction windows (timing restrictions to protect sensitive resources) cannot be met.

Pipeline would be transported by rail to four or five pipe staging areas measuring approximately 6.1 to 12.1 ha (15 to 30 acres) each. Pipe staging areas are locations where the pipe joints can be unloaded from railcars and temporarily stored while they await distribution (stringing) along the ROW. Potential staging areas near active or to-be-refurbished rail sidings include Everett, Easton, Ellensburg, Royal City, and Pasco. In addition to these pipe staging areas, contractors would have construction crew staging yards measuring 4 to 8 ha (10 to 20 acres) for office trailers and workcrew parking. The contractors would locate and make arrangements to secure a yard area for use by construction crews. This area would be used to locate office trailers, storage trailers, and fuel

tanks, and would operate as an assembly point for construction crews to meet prior to proceeding on to the ROW.

Pipe would be transported daily by tractor trailer to be placed along trenches for assembly. Construction would occur within a pipeline corridor that is 18 m (60 feet) wide or less, depending upon the width of the available corridor (such as in Tinkham Road which is a 3 to 6 m [10- to 20-foot] wide U.S. Forest Service Road). OPL has stated that the pipe would be placed a minimum of 3.1 meters (m) (10 feet) below major riverbeds, 1.2 m (4 feet) deep at other creek and water crossings, 1.8 m (6 feet) below railroad crossings, and 1.2 m (4 feet) below agricultural and other lands. River and stream crossings under any conditions would be placed a minimum of 0.6 m (2 feet) below projected maximum scour depths to meet federal DOT regulations. Specific scour depth potential would be determined during design.

The pipeline at each water crossing would be hydrostatically tested at least twice. A total of 1.5 million gallons of water would be needed to test the pipeline, plus 4.2 million gallons to test the tanks at the Kittitas Terminal. Water needed to conduct the hydrostatic testing would be obtained, if possible, from the Snoqualmie River, City of North Bend, Cascade Irrigation Canal, and Waluke Branch Canal. Potential secondary sources of water include the Alderwood Water District, Woodinville Water District, City of Carnation, City of Ellensburg, Port of Royal Slope, and the City of Othello.

After testing is complete, the test water would be analyzed and filtered before being discharged into a water body. Hydrostatic test water would be discharged into three locations: into the ground at the Stampede Pump Station, into the ground onsite at the Kittitas Terminal or into the Cascade Irrigation Canal near the terminal, and indirectly (through filtration) into the Snake River at the Pasco Terminal.

Operation

Pump stations would be controlled remotely from the OPL Renton facility and also controlled locally. The four OPL employees assigned to the OPL Renton facility would be responsible for local control and monitoring of product movements through the pipeline system. Four workers would be employed at the Kittitas Terminal during operation of the pipeline to handle incoming tanker truck loading activities. Two employees would be assigned to the Pasco Delivery Facility.

OPL would also contract with individuals or hire employees who live along the pipeline to respond to a spill within 1 hour of notification in accordance with state policy. It is OPL's policy to maintain a 60-minute response time. It is not known where these employees would be located or exactly how many contract employees would be hired.

An additional 6 to 10 OPL employees would be responsible for maintenance of the pipeline and the ROW. The width of the corridor to be maintained (i.e., the permanent easement) for the pipeline is 9.1 m (30 feet). The 30 feet would allow vehicles to access the area directly above the pipeline in the case of an emergency or for special inspection activities, and would enable small scale excavation of the pipeline where necessary for visual inspection and/or repair. Areas such as wetlands and farmland would not need maintenance clearing. Routine maintenance activities along the ROW

would include visual inspection, periodic clearing of vegetation, repairs to ROW markers, and inspection and maintenance of the cathodic protection system. Visual inspection of the pipeline would include regular ground patrols and aerial inspections about once every 2 weeks. A circular, computerized sensing device ("smart pig") would also be used, normally at 5-year intervals, to detect corrosion, dents, or other defects in the pipeline wall. Details about monitoring and maintenance would be provided after design and incorporated into approval requirements of the USFS, BLM, EFSEC, and other agencies. Details about spill response would be provided before operation as required by law.

No Action

Under No Action, shippers would continue to meet their additional needs with tanker trucks, ships, and barges. This would continue to be a more prevalent, more expensive, and less efficient transportation system for the shippers than the proposed pipeline. It would cost an estimated $0.55 more per barrel to transport product via barge to Pasco under No Action than with the proposed pipeline. It would cost more per barrel to truck product to Kittitas than to deliver it by pipeline, but actual savings depend on tariffs and transport distance. It costs approximately $0.02 per gallon to haul petroleum 75 miles, for example. This is $0.84 per barrel.

When the OPL line reached capacity in 1995, shippers continued to have three options for transport: OPL, Chevron pipeline, and Yellowstone pipeline. Of these, OPL received the greatest demand and rate of oversubscription. That rate will continue with No Action. Shippers desiring to purchase northwest refinery product cannot receive it from Chevron or Yellowstone.

In addition, No Action would require more transfers from one mode of transport to another (i.e., to trucks and barges), when accidents are more likely to occur. The oil spill risk analysis in the EIS demonstrates that No Action would have a greater frequency of spillage than the proposed pipeline and a greater risk of injury and fatalities to the public. There are problems with the current system, such as lack of capacity and severe delivery delays (12 hours to 3 days) on the mountain passes, and the quality of delivery would continue to degrade with more and more trucks and barges. Such problems in combination include weather delays affecting trucks, river or lock closures affecting barges, more transfers, more truck and barge traffic, and oversubscription.

Under the No Action Alternative, OPL would continue to operate its existing north-south pipeline system at its current at-capacity levels, and at rates that provide economic returns under tariffs approved by the Federal Energy Regulatory Commission and the Washington Utilities and Transportation Commission. Refined petroleum products from the refineries in northwestern Washington that are destined for central and eastern Washington would continue to be transported through the north-south pipeline and by other means, such as barges on Puget Sound (12 to 20 per month), the Columbia River, the Pacific Ocean and increased trucking.

Under No Action, because OPL is oversubscribed, increased trucking of product would continue to occur to help meet the increased demands for transportation of petroleum products. Truck traffic over the Cascades would rise from an average of 65 trucks per day in 1996 to an average of 128 trucks per day in 2026. Barging up the Columbia River would increase from about

292 trips annually in 1999 to 423 barge trips annually in 2019. Increased ocean barging would also occur, with subsequent transfer to the river barges in Vancouver/Portland for transport to Pasco. Increased Puget Sound barging would also occur with transfer at Harbor Island and onto truck for deliveries in western Washington and across Snoqualmie Pass. Barging on Puget Sound would range from 12 to 20 trips per month today to higher numbers, proportional to those above, in the future.

In contrast, if the project was built, upstream barging of petroleum product would cease on the Columbia River and Snake River, according to Tidewater Barge Lines representatives who control all such barging. Of the 65 trucks currently crossing the pass, all are either making local deliveries or are carrying product not available via pipeline due to oversubscription. These trucks would not have to cross the pass if the proposed pipeline is constructed.

ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

Alternatives to the project that were determined not to meet the need included rail transport of petroleum products from Woodinville or Portland to Pasco, demand management (product conservation or fuel switching to natural gas), construction of a new north-south pipeline system (increased throughput on the existing line, a new replacement line inside or outside of the existing ROW, and an independent or interconnected parallel line), and other means of transport (trucking, barging, and other combinations). Several alternative pipeline corridors were also considered (two Snoqualmie Pass routes, Yakima Valley route, Stampede Pass route, and Stevens Pass route), as well as other locations for the pump stations and terminal. These options were evaluated and eliminated from further study, based on detailed criteria that are explained in the EIS.

POTENTIAL IMPACTS

Four categories were used to evaluate potential impacts to the natural and built environments: none/negligible, minor, moderate, or major. For most resources discussed in the EIS, potential impacts from construction and operation are estimated to be negligible to minor because of pipeline siting and other measures OPL has proposed as part of the project to reduce impacts. However, some potential impacts such as from temporary lodging needs and from construction in riparian reserves, could be moderate or major. Impacts from an abnormal event such as an oil spill range from negligible to major depending upon the potential spill. Impacts and mitigation measures are summarized in Tables S-4 and S-5.

Table S-4. Summary of Moderate to Major* Construction Impacts and Mitigation for Proposal and No Action

Proposed Action		
Impacts	**Additional Mitigation Suggested**	**No Action**
Geology, Soils, Seismicity		
▪ Mass wasting could occur and, if near water bodies, could have a minor to moderate effect on them. ▪ Soil erosion could have a negligible to moderate impact on sedimentation, potentially affecting plants and animals, depending upon the volume of sediment released and the time of year that it occurred. ▪ Major impact could occur to the Columbia River if horizontal directional drilling results in a leakage of bentonite drilling fluids into the river through the permeable stream deposits or by hydrofracturing the formation. ▪ Trenching through Ginkgo Petrified Forest State Park could result in a small, localized, but irreplaceable loss of fossilized forest remains.	▪ Involve qualified contractors in the planning and implementation of drilling across the Columbia River. Prepare a feasibility study and initial drill alignment. Place an experienced pre-qualified driller on the rig at all times. ▪ Perform additional explorations of the Columbia River crossing ground conditions before final design. Implement a test horizontal directional drill program. ▪ Improve bore stability of Columbia River directional drill, such as by pre-assembling the entire pipe to allow a continuous pull and complete grouting of the hole during drilling. ▪ Consider using a polymer drilling fluid that would break down, rather than bentonite. ▪ Consider conducting a geological survey in Ginkgo Petrified Forest State Park to minimize destruction of fossil beds.	▪ Mass wasting impacts would not occur as a result of pipeline construction. ▪ Soil erosion and sedimentation impacts would not occur as a result of pipeline construction. ▪ Major impacts would not occur to the Columbia River from horizontal directional drilling
Botanical Resources		
▪ Moderate impacts from permanent loss (30-foot wide maintenance corridor) of riparian habitat and vegetation near salmon-bearing streams at stream crossings, such as the Tolt River, Griffin Creek, Tokul Creek, and Humpback Creak.	▪ In the revegetation plan and monitoring described below for all vegetation impacts, include willow wattling as a vegetation technique in riparian areas where revegetation could help stabilize streambanks and reduce erosion.	▪ No impacts would occur to riparian habitat and vegetation near salmon-bearing streams. ▪ No impacts would occur to state threatened or sensitive plant species.

Table S-4. Continued

Proposed Action		
Impacts	**Additional Mitigation Suggested**	**No Action**
Botanical Resources (continued)		
▪ Moderate impacts are expected to state threatened or sensitive plant species, including one population of pauper milk-vetch in Kittitas County, two populations of Piper's daisy in Grant County, and one population of Piper's daisy in Adams County. ▪ Moderate impacts are expected from disturbance of 540 acres of shrub-steppe plant communities (most are somewhat degraded), 26 percent of which is dominated by native shrubs and grasses. Restoration will be difficult and long-term (14 to 85 years). ▪ Moderate impacts to 2 acres of a high-quality native shrub-steppe community on the steep east bank of the Columbia River, dominated by sagebrush and native grasses with an intact cryptogam crust. ▪ Prepare a revegetation plan that specifies plant material size, planting densities, planting methods, seed mixes, application rates, timing of planting, and seed application. Include willow wattling as a vegetation technique in riparian areas where revegetation could help stabilize streambanks and reduce erosion. Monitor the revegetation plantings to ensure the revegetation plan is implemented as designed. ▪ Prepare a contingency plan before construction begins that has been reviewed and approved by USFS/BLM and that addresses revegetation performance standards and measures to be taken if standards are not achieved.	▪ Conduct additional field studies for the Piper's daisy and pauper milk-vetch to eliminate impacts by avoidance through rerouting, or reduce impacts by narrowing the construction corridor. Fence in the locations of sensitive plants that are to be avoided and use an onsite biological monitor during construction. ▪ Include bitterbrush in the shrub-steppe seed mix where it is part of the natural community. Implement an onsite seed collection program and propagate container-grown plants to plant in high-quality, native portions of plant communities.	▪ No impacts would occur to 540 acres of somewhat degraded shrub-steppe plant communities. ▪ No impacts would occur to 2 acres of high-quality native shrub-steppe community on the east bank of the Columbia River.
Wetlands		
▪ No moderate or major impacts were identified.	▪ None.	

Table S-4. Continued

Proposed Action: Impacts	Proposed Action: Additional Mitigation Suggested	No Action
Wildlife		
▪ Major impacts could occur if clearing took place during the spring nesting season (generally April 1 - July 15 of any given year) for sensitive species (i.e., northern goshawks, prairie falcons, ferruginous hawks, red-tailed hawks, burrowing owls, long-billed curlew, and sandhill cranes), then nest and/or den sites of wildlife (i.e., tailed frogs, night snake, striped whipsnake, and Washington ground squirrels) could be directly lost. Impacts are considered major because most species of birds are protected under the Migratory Bird Treaty Act and, therefore, are legally protected from "take," which includes destroying nests or eggs. ▪ Noise from construction adjacent to suitable habitat for threatened and endangered species could cause disruption of breeding behavior. ▪ Moderate, small-scaled, localize impacts to small mammals, game birds, and other wildlife from loss of shrub-steppe vegetation, as described under Vegetation. ▪ Moderate impacts to mammals from clearing trees located east of the Yakima River. ▪ Moderate impacts to wildlife from clearing 207.6 acres of scrub-shrub habitat along BPA transmission line easements.	▪ Conduct clearance surveys or do not blast within 1 mile of known marbled murrelet or spotted owl nest sites; habitat potentially suitable for marbled murrelet, northern spotted owl, or peregrine falcon; or known bald eagle winter use areas from November 1 - March 15. ▪ Conduct informal consultation with the USFWS for T&E species, marbled murrelet CHUs, and northern spotted owl CHUs. Provide USFWS needed information and develop and implement silvicultural prescriptions. ▪ Prohibit construction within 0.25 mile of the range of the northern spotted owl from March 15 - August 1, unless surveys have been completed and approved by the USFWS. Prohibit blasting anywhere within USFS lands during the northern spotted owl nesting season, unless approved by the USFWS. ▪ Prohibit construction within the range of the marbled murrelet from April 1 - September 15, unless surveys have been completed and approved by the USFWS. Prohibit blasting anywhere within USFS lands during the marbled murrelet nesting season, unless approved by the USFWS. ▪ Do not construct within 100 m of rivers and creeks from November 1 - March 15, unless clearance surveys are done to determine no bald eagles are present. Identify potential perch trees regularly used and replace if cut. ▪ Do not construct from March 15 - July 15 unless clearance surveys are done within 0.25 mile for raptor nests.	▪ No impacts would occur during the spring nesting season (April 1 - July 15) for sensitive species (i.e., northern goshawks, prairie falcons, ferruginous hawks, red-tailed hawks, burrowing owls, long-billed curlew, and sandhill cranes), and nest and/or den sites of wildlife (i.e., tailed frogs, night snake, striped whipsnake, and Washington ground squirrels) would not be lost. ▪ No noise impacts would occur to disrupt threatened and endangered species breeding behavior. ▪ No impacts would occur to small mammals, game birds, and other wildlife. ▪ No impacts would occur to mammals from clearing trees located east of the Yakima River. ▪ No impacts would occur from clearing 207.6 acres of scrub-shrub habitat along BPA transmission line easements.

Table S-4. Continued

Proposed Action		
Impacts	**Additional Mitigation Suggested**	**No Action**
Wildlife (continued)		
	▪ Limit vegetation clearance from March 15 - July 15 for other birds under the Migratory Bird Treaty Act, unless clearance surveys are done within 10 feet of clearing areas and approved by the USFWS. Prepare site-specific plans for nest site protection, with the USFWS and WDFW. ▪ Do not construct from March 15 - August 15 within 0.25 mile of active nest sites. Conduct clearance surveys for nesting burrowing owls. Construct replacement burrows per WDFW direction. ▪ Conduct clearance surveys for nesting long-billed curlew and avoid construction within 328 feet during the breeding season. ▪ Do not construct within areas mapped by WDFW as priority sandhill crane habitat from early March - mid-May or from mid-September - early November. ▪ Conduct clearance surveys in wetland, stream, river, and riparian habitats immediately prior to construction and remove tailed frogs, Cascades frogs, and other amphibians. Remove individuals and relocate eggs in accordance with WDFW and USFWS. ▪ Do not disturb snake hibernacula from October 15 - May 1, coordinate with WDFW and USFWS where this conflicts with other species. ▪ Cooperate with the WDFW for mitigation for Washington ground squirrels. ▪ Develop specific performance standards for restoration of each cover type that would be affected, obtain approval from the USFS, and monitor for success.	

Table S-4. Continued

Proposed Action		
Impacts	**Additional Mitigation Suggested**	**No Action**
Wildlife (continued)		
	■ Plant patches of shrubs within the ROW in adjacent parcels in cooperation with landowners. ■ Replace any trees removed east of the Yakima River with a 2:1 ratio of established nursery stock, with approval of WDFW. Conduct monitoring and maintain as necessary to ensure survival for 10 years. ■ Develop specific timing restrictions with WDFW to minimize disturbance to wintering deer and elk. ■ Conduct clearance surveys for bats prior to disturbing habitat within cliff areas. Establish timing restrictions if roosts/breeding areas are found.	
Water		
■ Moderate, short-term (less than 3 years) direct physical impacts from invasive trenching and bed and bank disturbance in 60 percent of the channels crossed (161 to 166). If blasting occurs in stream bedrock, shock waves could weaken residual bed material and unconsolidated bank material increasing their susceptibility to scouring and debris flow processes when saturated or at high flows. Streambeds could experience preferential scouring and sorting of the backfilled trench during the next bankfull or larger event. Sediments could be entrained and deposited in sensitive downstream reaches. ■ Major to minor, temporary impacts from invasive trenching causing erosion and sedimentation effects on water quality and channel conditions. Turbidity would likely exceed water quality standards during construction of crossings. ■ Major to minor impacts to water quality if substantial drilling muds seeped into the Columbia River.	■ Identify culverts and their capacities to pass flows from a 100-year storm event. Replace and record design criteria for replacement of inadequate culverts. ■ Monitor culvert and channel conditions at all replaced culverts for 1 - 3 years, for achievement of desired fish passage and erosion concerns. Take corrective actions as necessary. Add new culverts to the long-term monitoring plan for all stream crossings. ■ Consider leaving some larger cut trees in the riparian area to enhance long-term LWD recruitment, water crossing stabilization, or fish enhancement. Consult with wildland hydrologists and fisheries habitat managers prior to placement of LWD.	■ No impacts would occur to surface and groundwater resources and quality without the pipeline. However, the risk of oil spill-related impacts from trucks may increase as a result of more trucking of petroleum products. The same increased risk would occur for barging. ■ Little or no impact would occur to groundwater.

Table S-4. Continued

Proposed Action: Impacts	Proposed Action: Additional Mitigation Suggested	No Action
Water (continued)		
▪ Major, temporary impacts to City of Cle Elum, the Kittitas County PUD, and unlined irrigation canals in the lower Crab Creek drainage senior water rights if sediment impairs the use of those waters when needed, damages equipment, or increases treatment costs. ▪ Develop detailed stream crossing plans and specifications for sensitive stream crossings. Adapt these plans in the field for application to all of the crossings. ▪ Consider using a polymer that begins to break down naturally in a few days, in place of betonite for drilling. ▪ Monitor water quality downstream of trenched or drilled crossings during operation in or near channels known or suspected to contain salmonids. If a problem is detected, stop construction until situation is rectified. ▪ Coordinate timing of invasive crossings upslope of Cle Elum and Kittitas PUD water intakes with them. Construct crossings under low-flow conditions to minimize sediment transport in the Yakima River washload.	▪ Use water surface profile models and flood-elevations and field indicators to identify the 100-year flood boundary, and ensure adequate burial depth of the pipeline at crossings. Consult a hydrologist or geomorphologist to assist in identification. ▪ Bury the pipeline 2 feet below maximum scour depth throughout the entire floodplain. ▪ Monitor the most sensitive stream crossings more frequently and intensively than now proposed by OPL.	
Fisheries		
▪ Moderate, short-term, localized impacts on fish and fish habitats from sedimentation during trenching at 161 - 166 crossing sites or surface runoff, particularly where invasive stream crossings are proposed within or above spawning grounds. The impacts of sedimentation in spawning grounds would be expected to last 1 - 3 years, depending on streamflows. ▪ Moderate direct physical impacts to fish rearing and spawning habitat from invasive construction in 161 - 166 channels. Substrates would return to natural conditions within 3 years.	▪ Prepare site-specific crossing plans for streams with sensitive fisheries in cooperation and with approval from Federal and state agencies. Mitigate for short-term or permanent loss of fish habitat, as required by the agencies. ▪ Complete a detailed analysis of alternative non-invasive crossing methods for sensitive stream crossings. ▪ Replace culverts at Mill and Cold creek crossings to increase availability of bull trout spawning and rearing areas.	▪ No impacts would occur to fish and fish habitats from sedimentation during trenching at 161 - 166 crossing sites or surface runoff. ▪ No direct physical impacts would occur to fish rearing and spawning habitat in 161 - 166 channels. ▪ No impacts would occur to fish and habitat from spilled drilling muds.

Table S-4. Continued

Proposed Action: Impacts	Proposed Action: Additional Mitigation Suggested	No Action
Fisheries (continued)		
▪ Moderate to minor impacts to fish and habitat if substantial drilling muds seeped into the Columbia River, including T&E species. ▪ Major (if T&E species are affected) to no impacts to fish, fish eggs, and larvae if blasting occurs in stream bedrock. ▪ Moderate, short-term (less than 3 years) direct physical impacts to spawning habitat at the Tolt River and Cherry Creek crossing sites for T&E Puget Sound chinook salmon. ▪ Moderate to minor localized impacts on bull trout spawning habitat below the crossings of Roaring and Meadow creeks. ▪ If blasting occurs in or near streams that provide fish habitat, consult with appropriate agencies and prepare a blasting plan.	▪ Evaluate existing culverts and consult with agencies regarding requirements for their replacement. ▪ Provide construction and post-construction monitoring to ensure BMP effectiveness. ▪ Monitor downstream of all drill and bore crossings to minimize potential impacts from drilling mud spills. ▪ Drill the crossing of the Columbia River during WDFW work window requirements to minimize impacts from spilled drill muds on salmonids. ▪ Provide downstream monitoring of turbidity at all invasive stream crossing sites.	▪ No impacts would occur to fish, fish eggs, and larvae if blasting occurred. ▪ No direct physical impacts would occur to T&E Puget Sound chinook salmon spawning habitat on the Tolt River and Cherry Creek. ▪ No impacts would occur to bull trout spawning habitat below the crossings of Roaring and Meadow creeks.
Air Quality		
▪ No moderate or major impacts were identified.	▪ None	
Noise		
▪ No moderate or major impacts were identified.	▪ None	
Traffic and Transportation		
▪ No moderate or major impacts were identified.	▪ None	
Cultural/Historical Resources		
▪ No moderate or major impacts were identified.	▪ None	
Land and Shoreline Use		
▪ No moderate or major impacts were identified.	▪ None	
Agriculture		
▪ No moderate or major impacts were identified.	▪ None	

Table S-4. Continued

Proposed Action		
Impacts	**Additional Mitigation Suggested**	**No Action**
Recreation		
■ Minor to major impacts would occur to users of most of the 57 recreational facilities in the vicinity of the pipeline corridor. Most recreationists using the facilities would experience temporary (1 to 2 days, during daylight hours) dust, noise, and views of construction depending on the proximity of their activities to the 1,000-foot active construction zone, the movement of the construction from 2,000 to 10,000 feet per day, and the length of their stay. ■ Minor to major impacts to users of a state park, two trails, and two golf courses. The pipeline is being buried under an undeveloped but trailed portion of Twin Falls State Park, 7.4 miles of the Cedar Falls Trail, and 21.1 miles of the Iron Horse State Park/John Wayne Trail. The recreationists at these three facilities could experience temporary trail closures, for up to 1 hour. Vegetation along trails may be damaged during stockpiling of soil along the trench, affecting the visual quality of the recreational experience. Disturbed vegetation would likely recover in 1 to 2 years. The pipe would be buried in the Snoqualmie Tunnel, with temporary pedestrian closures (up to 1 hour) possible during the 2-week construction period. Equestrian users would likely be excluded for the entire 2 weeks. The pipeline would be buried in the rough, cart paths, or trails of Echo Falls Country Club and Mount Si Golf Course. Courses would remain open but interruptions could occur for 1 to 2 days. ■ Major impacts to historical campers from displacement by construction workers at two state parks, Lake Easton and Ginkgo Petrified Forest State Parks, and other public and private camping facilities. ■ Potential major impacts for historical users of limited trailhead, campground, and other recreational parking facilities if displaced by construction worker vehicles.	■ No additional mitigation measures are suggested beyond those proposed by OPL.	■ No impacts would occur to recreationists from dust, noise, and views of construction. ■ No direct impacts would occur to the state park, two trails, and two golf courses. Snoqualmie Tunnel would not be closed to equestrian users for two weeks. ■ No impacts would occur to historical campers/users at two state parks, Lake Easton and Ginkgo Petrified Forest State Parks, and other public and private camping facilities. ■ No impacts would occur to historical users of limited trailhead, campground, and other recreational parking facilities.

Table S-4. Continued

Proposed Action		
Impacts	**Additional Mitigation Suggested**	**No Action**
Visual Quality		
■ Moderate, temporary (2 - 3 years) impacts to suburban and rural residential areas (e.g., Woodinville and North Bend) from high viewer sensitivity near additional clearing of the ROW. ■ Moderate to major, temporary impacts to visual resources for recreationists are limited mostly to 28 miles of popular hiking trails and recreation sites, including sections of the pipeline corridor along Cedar Falls Trail, John Wayne Trail, Tinkham Campground/Annette Lake Trailhead in the Snoqualmie Pass area, and the Yakima River crossing. In the Snoqualmie Pass area, tree cutting would be minimized but soil stockpiling on one side of the trench would cover herbaceous plants and extend into adjacent trees where the trail corridor is narrow. Disturbed vegetation within the trail corridors is expected to recover in 1 to 2 years. At the Yakima River crossing, time for recovery of vegetation will be longer (15 to 40 years and possibly longer) due to the difficulty in restoring shrub-steppe vegetation. ■ Exceedance of the USFS VQO of Retention and Partial Retention within the Mt. Baker-Snoqualmie and Wenatchee National Forests. Corridor would be evident within the foreground of recreation trails and forest cuts on slopes connecting the router between trails. Utility corridors would be visible in the middleground of primary scenic travel corridors such as I-90. ■ Moderate impacts where the corridor passes adjacent to farm buildings at close viewing ranges, or runs along dirt roads.	■ No additional mitigation measures are suggested beyond those proposed by OPL.	■ No impacts would occur to visual quality and aesthetics.

Table S-4. Continued

Proposed Action		No Action
Impacts	**Additional Mitigation Suggested**	
Socioeconomics		
▪ Major impacts on availability of transient housing (hotels, motels, camping facilities) for historical recreational users would occur during the spring through fall because of displacement by non-local construction workers. ▪ Loss of housing for historical users to construction workers could subsequently result in moderate local impacts from reduced sales revenues, because of altered spending patterns, in recreation-related retail businesses. ▪ Lack of housing could also lead to moderate local pollution and health issues from unapproved camping and dumping of sewage wastes. ▪ Consultation with the tribes and the SHPO, and evaluation of impacts on traditional cultural properties or other resources is ongoing and will be completed in the Section 106 process.	▪ Negotiate with private RV and campground owners to expand their facilities at OPL's expense for exclusive use by the construction workers. ▪ Rent or arrange for use of local dormitories during off-season periods. ▪ Rent or arrange for use of local housing. ▪ Establish a sewage tank and pumping system to be used by construction workers. ▪ Development an approval of a Transient Worker Housing Plan. ▪ Consultation with the tribes and the SHPO on mitigation for traditional cultural properties or other resources is ongoing and will be completed in the Section 106 process. Phase II will include recommendations. ▪ Prepare a plan, meeting Native American Graves Protection and Repatriation Act requirements, specifying the treatment of human remains if discovered during construction.	▪ No impacts would occur to available transient housing (hotels, motels, camping facilities), historical recreational users would not be displaced. ▪ No impacts would occur from recreation-related reduced sales revenues for retail businesses. ▪ No impacts would occur from unapproved camping and dumping of sewage. ▪ No impacts would occur to traditional cultural properties or other resources.
Public Services and Utilities		
▪ No moderate or major impacts were identified.	▪ None.	
Health and Safety		
▪ No moderate or major impacts were identified.	▪ None.	▪
* This table summarizes only those impacts that would be moderate to major. Lesser impacts are described in the impacts analysis in Chapter 3.		

Table S-5. Summary of Moderate to Major* Operations Impacts and Mitigation for Proposal and No Action

Proposed Action		
Impacts	**Additional Mitigation Suggested**	**No Action**
Geology, Soils, Seismicity		
▪ Minor to major impacts if mass wasting and soil erosion occurred near water bodies. ▪ Moderate to major impacts from potential failure of the slope at Peoples Creek (and the Snoqualmie River 1.2 miles downstream of the crossing), compression or extension of the pipe at Cherry Creek and Tolt River, and a slide on the western shore of the Columbia River could result in a ruptured pipeline and product spill. ▪ Moderate to major impacts if an earthquake ruptured the pipeline. ▪ Moderate to major impacts could occur directly to streams if stream scouring (most likely during floods) or rapid lateral migration occurred, exposing the pipeline and rupturing it.	▪ Perform geotechnical investigations at mass wasting areas having high or moderate potential for slop failure. ▪ Concrete the rock portions of the slope of Peoples Creek and other similar creeks to buttress the slope and protect the pipe. Conduct subsurface explorations and detailed geotechnical studies to design this measure. ▪ Place block valves south of the slide and on the slope north of Cherry Creek. Install surface and subsurface drainage measures to increase slope stability. Conduct a subsurface exploration program to determine if other measures would be required. ▪ Consider installing flexible couplings at the top and toe of the landslide along the south slope of the Tolt River Valley to allow for creep movements of the earth mass. Block valves should be considered at this location. Block valves should be installed south of the top of the slide area and on the slope north of the river. ▪ Install block valves at the west side of the slide on the Columbia River. ▪ Evaluate potential for surface rupture along the active Saddle Mountains fault and, if needed, install flexible couplings, reinforce pipeline with increased wall thickness, and/or install block valves. ▪ Conduct detailed evaluations of scour potential at individual stream crossings to determine depths of pipeline burial to minimize potential pipeline exposure.	▪ No impacts would occur from mass wasting or soil erosion and a ruptured pipeline. ▪ No impacts would occur from slope failure and a rupture to Peoples Creek, Snoqualmie River, Cherry Creek, Tolt River, or the Columbia River. ▪ No impacts would occur from a pipeline rupture if an earthquake occurred. ▪ No impacts would occur directly to streams from stream scouring or rapid lateral migration and pipeline rupturing.

Table S-5. Continued

Proposed Action		
Impacts	**Additional Mitigation Suggested**	**No Action**
Geology, Soils, Seismicity (continued)		
	■ Where potential scour depth exceeds reasonable trenching depths, use horizontal directional drilling instead. ■ Install block valves on streams where a high or unpredictable scour potential exists. ■ Conduct studies to confirm that, where the pipeline placed in an embankment above or below existing culverts, culverts are adequately sized to accommodate peak flood events. Where areas are susceptible to mudflows and debris flows, consider use of horizontal directional drilling instead and the installation of block valves. ■ Conduct a flood study for horizontal directional drilling of the Columbia River to asses if floodwaters would cover the launch and receiving pit areas. If so, protect the pipeline from damage that could be caused by scouring. ■ If the Beverly Railroad Bridge is used for the Columbia River crossing, conduct a detailed structural analysis and seismic stability analysis to determine whether substantial rehabilitation of the bridge is required.	
Botanical Resources		
■ No moderate or major impacts were identified.	■ None.	
Wetlands		
■ No moderate or major impacts were identified.	■ None.	

Table S-5. Continued

Proposed Action		
Impacts	**Additional Mitigation Suggested**	**No Action**
Wildlife		
▪ Moderate impacts from permanent loss of 1.82 acres of northern spotted owl habitat within the 30-foot-wide corridor may result in a significant adverse modification of designated critical habitat, but would not likely affect viable populations.	▪ Develop and implement site-specific management plans, and consult with the WDFW, for areas that may be sensitive to regular entry and/or low-level flights. Areas could include nest sites, deer and elk winter range, and the sandhill crane migration area in the lower Crab Creek area. ▪ Do not conduct tree cutting maintenance from March 15 - July 15 (nesting season) unless clearance surveys are conducted to verify no nests are present. Conduct surveys in cooperation and approval from USFS or WDFW. ▪ Conduct aerial and driving inspections of the pipeline so that sandhill crane flocks are not disturbed. Develop and implement site-specific management plans in consultation with the WDFW and USFWS. ▪ Do not drive through wintering deer range when snow cover averages greater than 2 feet. Develop and implement site-specific management plans in consultation with the WDFW and USFWS.	▪ No impacts would occur from permanent loss of 1.82 acres of northern spotted owl habitat. ▪ No impacts would occur from permanent loss of 1.82 acres of northern spotted owl habitat.
Water		
▪ Moderate to major water quality impacts if stream erosion, migration, or scouring exposed the pipeline, a spill or chronic leak occurred, and product entered surface waters. ▪ Major impacts if a spill or chronic leak occurred and product contaminated needed senior water rights. ▪ Major groundwater quality and well/spring impacts if a spill or chronic leak occurred from corrosion or unauthorized excavation and product entered the groundwater.	▪ At each stream crossing, survey both of the elevations of the installed pipeline and the reconstructed streambed and banks. Install and survey a benchmark and a second reference point near each crossing. Monitor the cross-sectional morphology at each crossing at 1, 3, and 5 years after construction. Repeat monitoring after each storm event that substantially exceeds the peak storm observed in each WRIA during the first 5-year interval. Whenever the depth of the pipeline is halved relative to the original burial depth, notify appropriate agencies and assess whether stabilization measures are appropriate. If bed elevation reaches the original maximum scour depth, meet with agencies and identify and modify stabilization and spill prevention measures.	▪ No impacts would occur to water supplies and quality from the pipeline. However, increased trucking on roads across the same streams and along the same corridors (e.g., I-90) would increase risks of spills into those areas (although smaller in extent). Increased transfers and barging in the Pacific Ocean and on the Columbia River could lead to increased chances of spills and impacts to water quality.

Table S-5. Continued

Proposed Action		
Impacts	**Additional Mitigation Suggested**	**No Action**
Fisheries		
▪ Moderate to major impacts to fish, water quality, vegetation, sensitive areas, and possibly groundwater could occur if a spill or chronic leak occurred and product entered surface waters.	▪ No additional mitigation measures are suggested beyond OPL's implementation of the spill response and pollution prevention plan.	▪ Major to minor impacts on fisheries from increased use of tanker trucks and barges, associated increased likelihood of spills from accidents (although at lower volumes than the pipeline), and impacts to fisheries if spills occur in or reach nearby waterbodies.
Air Quality		
▪ No moderate or major impacts were identified.	▪ None.	
Noise		
▪ No moderate or major impacts were identified.	▪ None.	
Traffic and Transportation		
▪ No moderate or major impacts were identified.	▪ None.	
Cultural/Historical Resources		
▪ Consultation with the tribes and the SHPO, and evaluation of impacts on traditional cultural properties or other resources is ongoing and will be completed in the Section 106 process.	▪ Consultation with the tribes and the SHPO on mitigation for traditional cultural properties or other resources is ongoing and will be completed in the Section 106 process. ▪ Prepare a plan, meeting Native American Graves Protection and Repatriation Act requirements, specifying the treatment of human remains if discovered during operation.	▪ Increased trucking and barging would increase the probability of accidental damage from spills if they occur near identified and undiscovered sites along the Columbia River, below Pasco and along the I-90 corridor.
Land and Shoreline Use		
▪ The project is inconsistent with the Mt. Baker-Snoqualmie National Forest Land and Resource Management Plan, as amended by the NFP, because of removal of standing second-growth trees on lands designated as Late-Successional Reserves adjacent to the Humpback Creek crossing (#78). It may be inconsistent with other Standards and Guidelines also.	▪ No additional mitigation measures are suggested beyond those proposed by OPL.	▪ No impacts would occur to land and shoreline use.

Table S-5. Continued

Proposed Action		
Impacts	**Additional Mitigation Suggested**	**No Action**
Agriculture		
▪ No moderate or major impacts were identified.	▪ None.	
Recreation		
▪ No moderate or major impacts were identified.	▪ None.	
Visual Quality		
▪ Moderate impacts from the Beverly-Burke Pump Station because of proximity to Beverly-Burke Road and lack of screening. ▪ Major impacts from the Kittitas Terminal because of its industrial character in an agricultural/grazing area and its visual dominance from I-90.	▪ No additional mitigation measures are suggested beyond those proposed by OPL.	▪ No impacts would occur to visual quality and aesthetics.
Socioeconomics		
▪ Major impacts would occur to Tidewater Barge Lines, Inc. from loss of petroleum product shipping business, lost revenues and a potential lay off of 100 employees. ▪ Lost petroleum shipping for Tidewater could lead to moderate impacts to farmers and grain elevators from increased costs of shipping other commodities, such as grain, because of the loss in cost-efficiency of combined round-trip shipment of grain and petroleum products.	▪ Implement OPL-funded training or job placement services for Tidewater Barge Lines, Inc. employees who are laid off.	▪ No impacts would occur to Tidewater Barge Lines, Inc., resulting in retained revenues and employees. If more barge shipping of petroleum products were to occur to meet increasing demands in central and eastern Washington, Tidewater would experience increased revenue and potential increases in employee levels. ▪ No impacts would occur to the costs of shipping other commodities, such as grain.
Public Services and Utilities		
▪ No moderate or major impacts were identified.	▪ None.	

Table S-5. Continued

Proposed Action		
Impacts	**Additional Mitigation Suggested**	**No Action**
Health and Safety		
■ Major reduction of petroleum products shipping on Puget Sound and the Washington coast (12 to 20 shipments per month) and elimination of upriver barging of such products up the Columbia River. ■ New petroleum spill risk across Cascades and farming areas east of the Cascades to Pasco. ■ Elimination of two tank farm terminals on the Snake River. Creation of a new tank farm terminal at Kittitas. ■ Reduced accident and fatality rate associated with elimination of tank or truck activity across Cascade Passes.	■ Additional block valve near Keechelus Lake. ■ Additional protective coating at all exposed crossings. ■ Lined trench at sole source aquifer crossings.	■ Continually increasing risk of spills from barges on the Columbia River, from trucks across Stevens and Snoqualmie Passes, and from barges on Puget Sound. ■ Continued operation and risk of two terminals on the Snake River.

* This table summarizes only those impacts that would be moderate to major. Lesser impacts are described in the impacts analysis in Chapter 3.

Chapter 1. Purpose and Need

1.1 INTRODUCTION

Olympic Pipe Line Company (OPL), a petroleum pipeline company located in Renton, Washington, is proposing to construct and operate a new refined petroleum products pipeline in Washington. The new buried pipeline would have an initial capacity of 60,000 barrels (bbls) or 2,520,000 gallons per day, with three pump stations operating. Up to three additional stations would come online as demand increased to an ultimate capacity of up to 110,000 bbls (4,620,000 gallons) per day.

The proposed pipeline is approximately 370 kilometers (km) (230 miles) long and would be an extension of the existing 644 km (400-mile) OPL pipeline system. The proposed pipeline would begin near Woodinville in western Washington and terminate at an existing storage and distribution facility in Pasco in eastern Washington. A storage and distribution facility would be constructed at Kittitas, near Ellensburg.

OPL currently transports refined petroleum products for shippers in Washington from four northwest refineries (Tosco, Arco, Texaco, Shell) to various customers in Washington and Oregon via OPL's pipeline from the refineries south to Portland. OPL is a petroleum products carrier. Its primary mission is to carry product from these four refineries.

The purpose of the Proposed Action is to respond to a need to provide a cost-effective, efficient, environmentally sound means to transport refined petroleum products from western Washington refineries to central and eastern Washington to meet the long-range needs for product transportation. The applicant's proposal is to build a west-to-east pipeline to achieve that purpose.

Section 1.2 of this chapter describes the need for the Proposed Action. Section 1.3 explains the criteria used to define the proposal's purpose. Section 1.4 provides a context for this discussion by describing the present petroleum supply and distribution system in Washington state, including the roles of key entities such as refineries, shippers, and carriers. Section 1.4 also describes how the EIS was developed around this Purpose and Need statement, and Section 1.5 describes the roles of agencies involved in the decision-making process. Section 1.6 summarizes relevant federal and state plans and guidelines. Section 1.7 lists potential users of the proposed pipeline.

1.2 NEED FOR ACTION

1.2.1 Overview

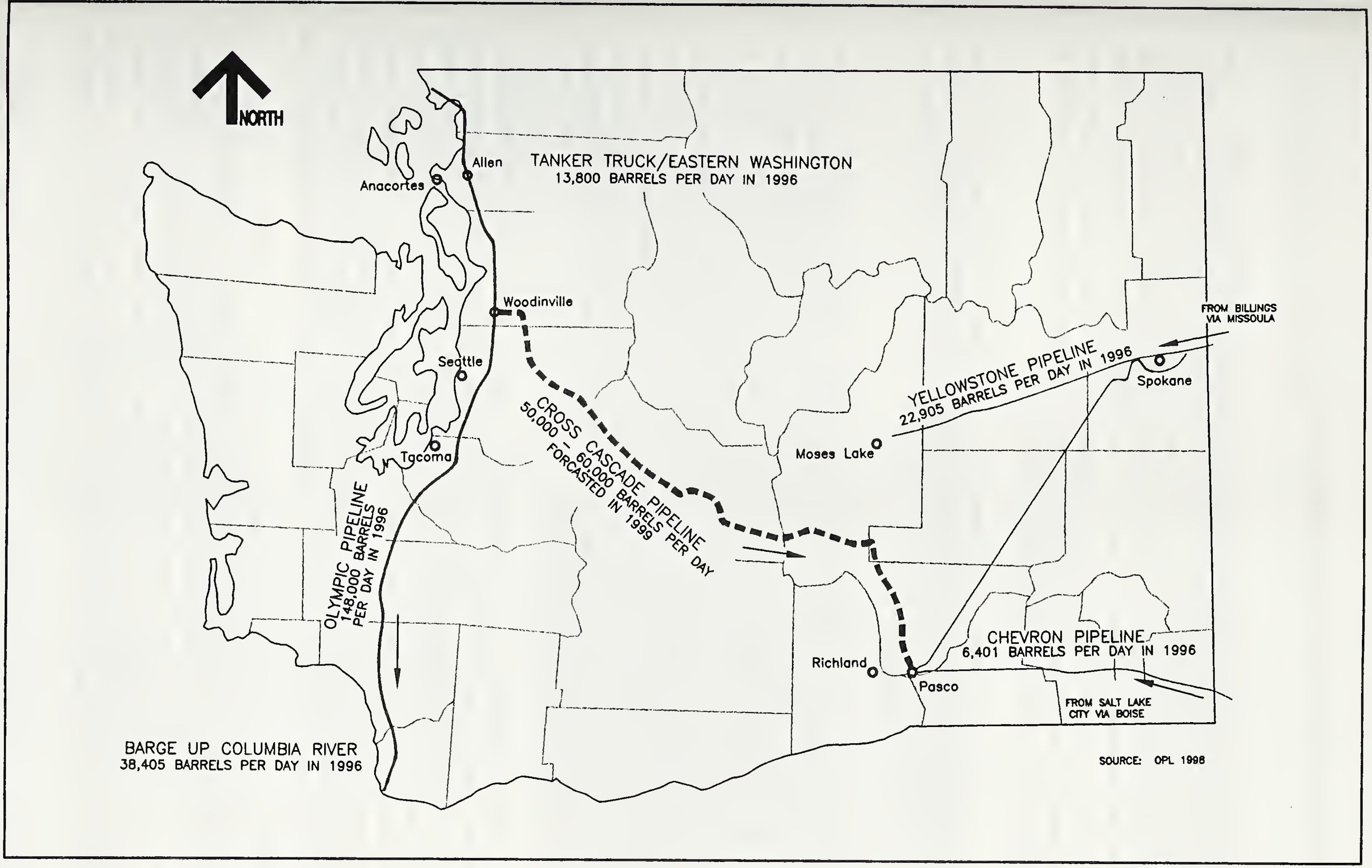
As central and eastern Washington continue to grow, more petroleum products are required. Although historically petroleum products have been delivered to these areas from a combination of California refineries, Rocky Mountain refineries (via the Yellowstone and Chevron pipelines), and northwest Washington refineries, the market trend is toward meeting the increases in demand with product from northwest Washington refineries.

Product from northwest Washington refineries can end up anywhere in the state but is largely distributed within western Washington, eastern Washington in the Tri-Cities area, and central Washington near Ellensburg. The primary mechanisms of transport, as shown in Figure 1-1, are:

- the north-south pipeline serving western Washington and Oregon customers from Seattle to Portland;
- trucks from Harbor Island in Seattle and directly from refineries crossing the Cascades via Snoqualmie and Stevens Passes to central Washington and the Moses Lake and Ellensburg areas; and
- barges on the Columbia River which pick up product from the pipeline in Portland and carry it to Pasco, Umatilla, and Clarkston.

Other secondary transport mechanisms, especially those involved with proration, are discussed further below. In 1995, the north-south pipeline reached capacity. Nonetheless, shippers have continued to order product from Washington refineries, even when the preferred delivery system (the north-south pipeline) was at capacity and alternate systems of delivery (truck and barge) were required.

With expected continued population and commerce growth in western, central, and eastern Washington, and demand on the OPL system from all three areas, OPL believes that the demand for the transport of products in their system, including products delivered to central and eastern Washington from western Washington refineries, will continue to increase about 1.5 percent annually (OPL 1998). As the amount of proration continues to increase, as detailed in the following sections, shippers will be required to increase their use of multiple sources and modes of shipment to meet increasing demands for refined product. This demand has created a request by shippers for a more price-competitive means of delivery of refined petroleum products from western Washington refineries. Shippers have asked OPL to examine whether a new pipeline could transport product to eastern and central Washington at a lower cost than the current barge and truck system. The proposed project, then, is primarily offered as a solution to shippers' request for a lower cost, more efficient, west-to-east delivery system, which would replace barges and trucks. Enough qualified shippers have signed letters of interest with OPL to fill half the proposed line at this time (see Section 1.7, Potential Users of Cross Cascade Pipeline Project).



EXISTING PETROLEUM PRODUCT SHIPPING AND PIPELINES IN WASHINGTON STATE.

Cross Cascade Pipeline
Washington
FIGURE 1-1

1.2.2 History

OPL's existing pipeline system has served western Washington and Oregon since 1965. It was created to carry northwest refinery products to customers in western Washington and Oregon. Over the years, it has also been a link in the transportation system supplying markets east of the Cascade Mountains. Other sources have also served eastern Washington -- the refineries of Billings and Salt Lake City and their associated pipeline systems, the Yellowstone and Chevron pipelines. Over the past 7 years, decreased crude oil supply, increased demand in local markets outside of Washington, and refinery closures have reduced the amount of Rocky Mountain refined product available at competitive product and transport costs in eastern Washington.

In the late 1980s, the volumes of refined petroleum product from the northwest refineries and other sources being transported into central and eastern Washington and Oregon started to increase (OPL 1998). This resulted in greater demands on all systems available to carry products east (pipeline, trucks, and river barges).

OPL responded to this increased demand on their pipeline system from shippers in western, central, and eastern Washington. From 1989 to early 1995, OPL added pumping equipment, began using flow-improving polymers, and added motor horsepower to add about 28,000 bbls per day capacity to the north-south pipeline to Vancouver and Portland for a total delivery capacity of 148,000 bbls per day (OPL 1998). However, these measures alone failed to keep pace with the demand on the existing system. Although OPL was able to increase transportation of product through the line to maximum capacity, shippers were forced to use increasing numbers of tanker trucks and barges to obtain needed product. As a result, eastern and western Washington shippers were curtailed and had to order product via other means. Under such conditions, common carrier pipelines are referred to as "oversubscribed" and pipeline owners are required to "prorate" the volumes they carry, so the shortage is allocated equally to all shippers.

By 1996, an average of 13,800 bbls of product per day (73 tanker-trailer truck trips) were trucked over the Cascades, and 38,405 bbls per day (3 to 4 barge trips per week) were barged up the Columbia to serve eastern Washington at Pasco (OPL 1998). The existing OPL pipeline system had reached its capacity for shipments from the refineries near Anacortes to Seattle and Vancouver/Portland in 1995. Shipment of refined petroleum products to central and eastern Washington from all sources and by all transportation modes in 1996, including the Yellowstone and Chevron pipelines through eastern Washington, was estimated to total 81,511 bbls per day (OPL 1998), and 52,205 bbls of this total were ordered from the northwest refineries (see Figure 1-1) via truck and barge.

Although the OPL pipeline is operating at capacity, shippers continue to increase requests for northwest refinery output from OPL and other sources at an increasing rate of approximately 1.5 percent per year. When shippers' needs cannot be met by OPL, they have product shipped by other carriers. This results in barge traffic on Puget Sound from northwest refineries to Harbor Island. Barge and product tankers sail from the refineries out the Strait and down the coast to Portland for local deliveries or for shipment up the Columbia. The refineries are making approximately 12 to

20 such shipments per month. Trucking companies carry product from Harbor Island to Olympia or across Snoqualmie or Stevens Pass.

With the existing north-south OPL pipeline capacity fixed at 148,000 bbls per day, the frequency of all these modes of transportation will continue to increase. Each of these modes costs more to transport than a pipeline. The transport costs of all these modes have the most dramatic effect on eastern Washington shippers because a greater percent of their future needs will be met by more expensive barging and trucking.

1.2.3 Conclusion

Demand for western Washington petroleum in eastern and central Washington has reached a volume of product where a new pipeline can be more efficient and less expensive to shippers than other modes of transport. As OPL's existing pipeline reached capacity, initial needs were met with occasional truck trips over the pass. As demand grew, more trucks were used and barge transport began, initially by back-hauling product in barges used to ship other products down river. Truck and barge transport have grown to be such a major portion of supply that shippers have asked OPL if a pipeline could be built to deliver product at lower cost than truck or barge with their associated transfer and storage costs. Along with lower cost would likely come efficiency and reliability, although the primary driver is transportation cost. Efficiency and reliabiilty of transport is reflected by fewer transfers of product and fewer delivery disruptions due to road closures from accidents and weather. Along with a lower cost, larger size, and more efficient system would come the elimination of the need to prorate shippers. This is another benefit to shippers who could count on one transportation source if the project were approved rather than supplementing their needs with more barging and trucking. OPL has investigated this pipeline option and determined that volumes are now sufficient to build and operate a pipeline to transport needed product at lower costs and greater reliability than the current system or other alternatives. Shippers have committed to use the line, as described in Section 1.7.

1.3 PURPOSE AND NEED CRITERIA

This section provides a very brief definition of the criteria used to define the purpose of the proposal and the alternatives.

Cost Effective. Shippers have requested a system which is less expensive to them than barge and truck delivery. Any alternative that is more expensive than the existing system would not be used and does not meet the need. Alternatives costing the same or less than the existing system are relatively cost-effective.

Efficient. Any alternative that includes fewer transfers of product between modes of transport than the existing system would be more efficient. Any alternative that is more reliable than the existing system would also be more efficient.

Environmentally Sound. Any alternative with the same or fewer impacts to the environment than the existing system would be environmentally sound.

1.4 BACKGROUND

1.4.1 Petroleum Supply and Demand in Washington State

A simple discussion of the mechanisms of petroleum product refining, transport, and consumption in the Northwest provides the reader with some context as to the role of OPL and other petroleum transport mechanisms in Washington state. The following discussion describes the roles of carriers, shippers, and the factors which generate a need for product, together with the systems that are in place to satisfy that need.

Users of petroleum products enter contracts with shippers to keep them supplied with product. In turn, shippers contract with refineries to supply petroleum product, with carriers to transport product, and with terminals to store product. Each of these entities and their operation in the market is described below.

Existing Oil Pipelines Serving Washington. Three major petroleum product lines deliver refined product to Washington state (Figure 1-1): OPL's north-south line, the Yellowstone line, and the Chevron line. Each line carries refined product from a relatively fixed supply base of refineries to customers anywhere in the state who are willing to pay for transport of the product. The lines are somewhat limited as to the product they carry, but there is no physical limitation as to the ultimate destination of the product because trucks or other methods can provide local distribution from any line to any location. Figure 1-1 shows general locations of these systems with relative flow data.

What limits the ultimate destination of the product is, of course, the demand for product from any one line, which is generally determined by price and availability. Price to shippers is affected by transportation costs and cost of the product, among other factors. Another major factor considered by shippers when transporting product is competition, because shippers order product for their customers based on price and reliability in a competitive market. Availability becomes critical when a line is oversubscribed and there are no other alternatives for transport. In most cases, including this one, there are other alternatives.

Shippers and Carriers. Gasoline, diesel, and jet fuel are transported to market via pipelines or other transport mechanisms (barge, rail, truck) based on orders placed by shippers who order products to supply gas stations, terminals, airports, and storage facilities of other users. Shippers often supply bulk distribution facilities, although some shippers are the ultimate consumers (e.g., airlines). When shippers see that their customers need product, they are responsible for seeing that this product is provided. Shippers arrange for the product to be purchased, transported, stored, and delivered.

Some shippers represent the refineries. Others are independent such as farm cooperatives, airlines, defense facilities, and others.

The pipeline companies are carriers as are trucking companies and barge lines. Neither shippers nor carriers are always the ultimate consumers. Carriers transport product, they do not produce it, nor do they decide where it goes or provide it to consumers. OPL is a carrier. This is important when considering demand and need.

Shippers are generally free to acquire product from whomever they want. In an open, competitive market, a shipper who is responsible for providing product to a Pasco customer (or to itself) could contact the Yellowstone, Chevron, or Olympic pipeline companies, depending upon which oil company they bought the product from. Such purchase is usually a multi-year contract. They then make arrangements for storing the product, if necessary, if various transport modes are used. Demand on any pipeline carrier, then, is dependent on the number and volume of requests they get from shippers. It is not a factor of supply and demand or local need for gas, for example. It is a response to shippers.

External factors of product price, transport reliability, supply, transport cost, storage cost, and other factors are all known to the shippers before they make their orders. Regardless of the size, capacity, or location of a pipeline, the shippers determine demand on the pipeline and the need to carry product. They make similar demands on truck and barge companies when pipelines are not available. This is noteworthy because it is the shippers who generally determine the flow, volumes, size or create the market for a pipeline, not the pipeline company itself.

Refineries. This EIS refers to northwest refineries, Rocky Mountain refineries, and California refineries. Each of these groups currently supplies some of Washington's petroleum. The relevant northwest refineries include two near Anacortes and two near Cherry Point. The four northwest refineries are served by OPL. The Rocky Mountain refineries include some in Missoula, Montana, served by Yellowstone pipeline, and in Salt Lake City, Utah, served by Chevron pipeline. The California Chevron refinery is in Richmond in the San Francisco Bay area; it provides some product to Portland for shipping up the Columbia.

1.4.2 Purpose and Need Considerations for the Project

Under the National Environmental Policy Act (NEPA), alternatives to be considered in the environmental impact statement (EIS) must meet the Purpose and Need. Those that don't meet the need do not have to be brought forward and discussed in the EIS. Alternatives that do meet the need must be considered, even if they are alternatives that are not under the Lead Agency's jurisdiction or control. A No Action Alternative must be considered and its impacts shown. The alternative with least impact need not be chosen by the applicant or responsible official. An EIS is strictly a disclosure document to require consideration of alternatives and impacts.

This EIS is intended to evaluate alternatives that meet the need established by the Lead Agencies. As described in the Introduction, the Purpose and Need statement for this proposal is as follows.

> The purpose of the Proposed Action is to respond to a need to provide a cost-effective, efficient, environmentally sound means to transport refined petroleum products from western Washington refineries to central and eastern Washington to meet the long-range needs for product transportation. The applicant's proposal is to build a west-to-east pipeline to achieve that purpose.

The lead agencies developed a Purpose and Need statement that considered alternatives other than the proposal, that considered the applicant's need and position, that considered alternatives outside the control of the applicant or Lead Agencies, that will be helpful to the decision maker, and that recognized the supply and demand situation of a world commodity in Washington state. Early in the process, it became evident that this is not a proposal to satisfy a petroleum shortage in central and eastern Washington. The U.S. transportation system is such that there are no local or regional petroleum shortages in the U.S. The demand is essentially met at all times throughout the country. It may take trucks, rail, ships, barges, or other means, but unless delayed by weather, road conditions, river conditions, or equipment failure, it is met. If a pipeline applicant, or an applicant for a tank farm, refinery, or gas station, had to show shortages leading to problems such as gas lines, rationing, or closed airports in order for an applicant's project to be built, no such projects would be built. This is a proposal for a pipeline which can deliver product from western Washington refineries at lower costs to shippers and with greater efficiency than the existing barge and truck system, now that existing transport volumes to central and eastern Washington are sufficient to economically support a pipeline. As clearly as the need for a lower cost alternative can be shown, this does not mean that it is in the best interest of the public to build it. That decision is up to the decisionmakers.

The need statement considers the need to respond to delivery demands of shippers for products produced by northwest refineries. At present, these products are carried, for the most part, by the applicant. The need statement considers the applicant's purpose in proposing a project to meet that need. Once the statement is defined, all "practicable" alternatives meeting that need must be considered. The applicant's need is to satisfy the requests of shippers that product be shipped at lower cost and greater efficiency from western to eastern Washington. The need recognizes the fact that the applicant carries product from four northwest refineries. No other pipeline system does that. Barges and trucks do, another pipeline could, and other modes such as rail could. These alternatives are described in detail in Chapter 2.

Another factor considered by the Lead Agencies is that the shippers' need for lower cost transport reflects a shift in demand for northwest refinery product from nearly exclusive western Washington shippers and consumers, when the original line was built, to many more central and eastern Washington shippers today. The amount of demand from central and eastern Washington shippers on the OPL system is directly demonstrated by the volumes of product hauled daily via truck and barge to that destination. This need is in two parts: (1) a need for product in central Washington (Kittitas, Ellensburg, Moses Lake) which is met by truck, and (2) a need for product in the Pasco area which is met by barge.

Another factor in considering alternatives, although not dominant in the need statement and alternatives considered, is the need for an EIS document that helps the decision maker. NEPA recognized this when it limited alternatives to those meeting the Purpose and Need and stated that "remote and speculative" alternatives, impacts, or analyses were not needed or useful. This applies to other existing pipelines, perhaps, which do not ship northwest refinery products, have no plans to expand, don't have the existing capacity or product to meet the need, and are not being asked to. Does it help the decisionmaker to evaluate them as alternatives regardless? The Lead Agencies have concluded that it doesn't.

1.4.3 Purpose and Need and the Public Interest

The public interest was considered in determining the need for the project and range of the alternatives. The lead agencies broadened the applicant's original need statement for a "pipeline" to include all possible modes of transport and routes. The proposal would use public lands, and impact waters of the U.S. and waters of the state. As a result, alternatives to such use should be considered. The OPL line is a common carrier for use by any qualified shipper to deliver product. It is regulated as a public utility with published rates, carrying product for final consumption by the public. The Lead Agencies desired a Purpose and Need statement that would allow other transportation options to be considered while still considering the acceptable option of using public lands, since this proposal is not without public benefit. Balancing the use of public lands vs. benefits of the project is not attempted here.

Underlying this element of the need is the public interest over the long term, the public's interest in having this need met, and the need that shippers have to use an efficient system over the long term. Overall, there is a well recognized public need for and public interest in petroleum product transportation via common carrier pipelines. That public need and public interest can be demonstrated as follows:

- As a common carrier pipeline with public access to all qualified shippers, a common carrier line serves airports, airlines, shipping companies, military installations, and all other private and public shippers in the public interest.

- Common carrier pipelines are given eminent domain rights (right of condemnation) by the government, which represents the public, because such pipelines are regulated as a public utility and governments have recognized that it is in the public interest to do so. Eminent domain is the result of the public concluding that their interest is superior to any single landowner's.

- The federal government recognizes the public interest of petroleum pipelines crossing federal lands where such utilities are a permitted use because Congress, through the Mineral Leasing Act, recognized that such pipelines can be in the public interest. That is why utilities are listed as an allowable use across federal lands. The use of public lands is authorized when its use is appropriate. This same right is not granted to private, non-utility uses.

- Common carrier petroleum pipelines are a regulated utility recognized to be in the public interest by the Federal Energy Regulatory Commission (FERC) and by state utilities commissions, subject to conditions of review, approval, and rate structure. Their rates are publicly regulated in exchange for certain rights which are granted to utilities in the public interest.

As a result of this public interest factor, any alternative means to meet the need should also consider and be in the public interest. Any consideration of an alternative must include its means to meet the public interest compared to No Action or other alternatives. The foregoing discussion does not conclude that this particular project is in the public interest, just that energy projects including common carrier petroleum pipelines can be in the public interest by their very nature. It is up to agency decisionmakers to determine if this project, or any of its alternatives, is in the public interest, compared to No Action.

For purposes of this EIS and this project, public interest factors considered may include public utilities, public resources, public lands, public need for energy, public health and safety, recreation, commercial harvest of trees or fish, public tax expenditures, and other public interests. Also of interest is not just the use of public resources, but possibly the degree of use and exclusion of other uses. For example, the proposal uses federal lands for ROW but would continue to allow nearly every other public use of such land along the ROW. River barges (part of the No Action Alternative) use publicly financed locks on the Columbia River at no charge to the users, but such use is still infrequent, only precluding other uses during barge use. Both commit public facilities or resources to private use.

This discussion demonstrates that utilities such as the proposed common carrier petroleum pipeline can be in the public interest. This discussion does not conclude that the Cross Cascade pipeline is in the public interest compared to its impacts, or to those of No Action. It is for the environmental analysis, risk assessment, and agency decisionmakers to decide this issue.

There are factors about this particular proposal specifically that are in the public interest. For example, the public relies on the products delivered by the pipeline system. As discussed further in Traffic andTransportation, weather conditions in the past have been so sever across the passes that fuel deliveries were disrupted for days. The Kittitas County sheriff requested and received an escorted convoy of fuel tanker trucks across Snoqualmie Pass to supply the public's emergency needs when the road was closed. This would not be needed with a pipeline. Likewise, all barging on the Columbia River was prohibited when the river was closed due to flooding during that same winter. Fuel products destined for ultimate consumption by the public could not travel by barge. The public relies on aviation fuel at airports such as Sea-Tac. Due to pro-ration, airports must supplement fuel needs with other transport options such as trucking or barging all the way from the source. The supply is met completely with the new pipeline, resulting in more efficient and less expensive deliveries to commercial airports.

Still another factor to consider in deciding upon alternatives is the evolving status quo and its related "No Action" impacts. Unlike some proposed facility projects where No Action means no facility, no impacts, and nothing much to examine, there is now a petroleum products delivery system in place and growing in Washington. It has impacts as does the proposal. The decisionmakers,

including the responsible official, permitting agencies, and the governor, will be committing to those existing impacts if the proposal is denied. The No Action Alternative in this EIS examines other pipelines' abilities to meet the need. The No Action Alternative requires examination of alternative pipelines and other modes that would not be examined as practicable alternatives. These are alternatives that some commentors have asked be included. Although they are not alternatives brought forward as meeting the Purpose and Need, they are brought forward as part of No Action as described in Chapter 2.

After consideration of many factors, the U.S. Forest Service and Washington Energy Facility Site Evaluation Council (EFSEC), as Lead Agencies on this NEPA/SEPA EIS, have determined that the Purpose and Need statement for this EIS is appropriate, in the public interest, and consistent with the authorization conveyed to the Bureau of Land Management under the Mineral Leasing Act.

1.5 AGENCY ROLES AND DECISIONS TO BE MADE

Numerous agencies are involved in EIS preparation, consultation, and permitting decisions for the pipeline project, as shown in Table 1-1. Of these agencies, the Bureau of Land Management (BLM) and EFSEC play key roles in issuing "umbrella" authorizations that incorporate the input of other agencies, while EFSEC and the U.S. Forest Service have served as Lead Agencies in preparing this EIS. The roles of these three agencies are highlighted below:

- **Bureau of Land Management.** The Mineral Leasing Act (MLA) was amended, in part (87 Stat. 576 and ff.), to provide efficiencies in granting MLA rights-of-way across federal lands managed by multiple agencies by providing applicants the convenience of one application process and one authorization document. The Secretary of the Interior, through the BLM, is mandated to process MLA applications across federal lands managed by more than one agency with the prior consent of each agency head (the exact wording can be found at 87 Stat. 577 [sec.9(c)(2) of Act of Nov. 16, 1973 {P.L. 93-153}]). The regulations at 43 CFR 2880.0-7(a) reflect this statutory mandate. BLM, in accordance with the Act, will not issue a right-of-way (ROW) across federal lands without the consent of the respective agency heads. This consent will be required before the BLM will issue a Record Of Decision (ROD). The BLM will request consents, in writing, from the agency heads. Assuming a ROD is affirmative, BLM will then issue one authorization (right-of-way grant) under the MLA for use of all federal lands. No additional authorization documents are required from other affected federal land managing agencies under the MLA. Subsequently, Notice(s) To Proceed will be issued as appropriate.

- **Washington State Energy Facility Site Evaluation Council.** EFSEC coordinates all of the evaluation and licensing steps for siting major energy facilities in Washington. If a project is approved, EFSEC specifies the conditions of construction and operation, issues a Site Certification Agreement in lieu of any other individual state or local agency authority, and manages the environmental and safety oversight program of project operations. As part of EFSEC's permitting process, OPL submitted an Application for Site Certification on February 5, 1996 and an amended application in May 1998. EFSEC

Table 1-1. Permit, Approval, and Consultation Requirements for the Proposed Pipeline Project

Agency	Permit/Authority	Agency Action
Federal Government		
Advisory Council for Historic Preservation	Consultation under Section 106/ *National Historic Preservation Act*	The Council would participate in consultation under Section 106 for all project features that may potentially affect cultural resources that are eligible for listing or are listed in the National Register of Historic Places (NRHP).
U.S. Army Corps of Engineers (ACOE)	Cooperating agency	Cooperating with U.S. Forest Service and EFSEC in preparation of EIS for pipeline project.
	Section 404(b)(1) Individual Permit/ *Clean Water Act*	ACOE would consider issuance of Section 404 individual permits for physical features or activities that result in the placement of dredge or fill material in Waters of the United States. The U.S. Environmental Protection Agency would advise ACOE regarding permit issuance.
	Section 10 Permit/ *Rivers and Harbors Act of 1899*	ACOE would consider issuance of Section 10 permits for the portions of the pipeline that cross navigable waters.
U.S. Department of the Interior, Bureau of Land Management (BLM)	Record of Decision (ROD)/ *Minerals Leasing Act: Title I, Section 28 (c)(2) of the Mineral Leasing Act of 1920, as amended, November 16, 1973 authorizes the Secretary of the Interior to grant or renew rights-of-way (ROW) or permits and to enter into agreements with other land-managing federal agencies for the processing of applications for pipelines to transport oil, natural gas, synthetic liquid or gaseous fuels, or refined products produced therefrom.*	BLM would issue a decision on granting right-of-way (ROW) across all Federal lands. The Spokane District Manager is the Responsible Official for the EIS and ROD. The ROD would be issued once all permits, approvals, and consultations are completed (e.g., NHPA consultation, Endangered Species Act consultation, Section 404 individual permit, Section 10 permit, and separate approvals from each of the land management agencies).
	Right-of-Way (ROW) Grant/ *Minerals Leasing Act*	BLM would offer the ROW grant across all Federal public lands crossed by the pipeline project. The Spokane District Manager is the Authorized Officer for the ROW grant application.
	Temporary Use Permit/ *Minerals Leasing Act*	BLM would issue this permit for temporary activities in a construction ROW. The Spokane District Manager is the Authorized Officer for the Temporary Use Permit.

Table 1-1. Permit, Approval, and Consultation Requirements for the Proposed Pipeline Project

Agency	Permit/Authority	Agency Action
U.S. Department of the Interior, Bureau of Land Management (BLM) - continued	Notice to Proceed	BLM would issue this order once all the agency input and concurrence have been received concerning the ROD/ROW grant and documented in the construction, operations, and maintenance plan. Once the plan is approved, the Authorized Officer would issue a Notice to Proceed with all project development activities.
	Antiquities and Cultural Resources Use Permit	BLM would consider issuing a permit to survey, identify, excavate, or remove cultural resources on Federal lands under FLPMA and ARPA as necessary prior to site preparation.
	Consultation	BLM would approve detailed construction, operation, rehabilitation, and environmental protection plans.
U.S. Department of the Interior, Bureau of Reclamation (USBR)	Cooperating agency	Cooperating with U.S. Forest Service and EFSEC in preparation of EIS for pipeline project.
	Consultation and concurrence	Following issuance of the Final EIS, USBR must provide BLM with either an approval or denial for the ROW. USBR reviews the construction, operation, and maintenance plan, and provides mitigating measures and stipulations to BLM to be included in the ROW document; also conducts onsite inspections prior to construction.
U.S. Department of Defense (DOD), U.S. Army	Cooperating agency	Cooperating with U.S. Forest Service and EFSEC in preparation of EIS for pipeline project.
	Consultation and concurrence	Following issuance of the Final EIS, DOD must provide BLM with either an approval or denial for the ROW if proposed across their land. DOD reviews construction, operation, and maintenance plan, and provides mitigating measures and stipulations to BLM to be included in the ROW document. DOD conducts onsite inspections prior to construction.
U.S. Department of the Interior, U.S. Fish and Wildlife Service (USFWS)	Cooperating agency	Cooperating with U.S. Forest Service and EFSEC in preparation of EIS for pipeline project.
	Consultation and concurrence	Following issuance of the Final EIS, USFWS must provide BLM with either an approval or denial for the ROW. USFWS reviews construction, operation, and maintenance plan, and provides mitigating measures and stipulations to BLM to be included in the ROW document. USFWS conducts onsite inspections prior to construction.
	Section 7 and 10 Biological Opinion/ *Endangered Species Act*	USFWS would provide a biological opinion on species of wildlife and plants that are federally listed.

Continued

Table 1-1. Permit, Approval, and Consultation Requirements for the Proposed Pipeline Project

Agency	Permit/Authority	Agency Action
U.S. Department of Agriculture, U.S. Forest Service (USFS)	Co-lead agency	USFS is co-lead agency with EFSEC for preparation of the EIS, to ensure the compliance of the project with NEPA and the Council on Environmental Quality regulations for implementing NEPA (40 CFR 1500-1508). This responsibility includes coordination of all federal agencies in the development of an EIS and monitoring compliance of the project construction with the ROW grant. BLM still retains authority for the coordination of cost recovery, issuance, and administration of the ROW grant for all federal lands involved in the project once construction is completed.
	Consultation and concurrence	Following issuance of the Final EIS, USFS must provide BLM with either an approval or denial for the ROW. USFS reviews construction, operation, and maintenance plan, and provides mitigating measures and stipulations to BLM to be included in the ROW document. USFS conducts onsite inspections prior to construction.
State Government		
State of Washington, Energy Facility Site Evaluation Council (EFSEC)	Co-Lead Agency and Site Certification Agreement/ *EFSEC's responsibilities derive from the Revised Code of Washington (RCW) 80.50, and include siting large natural gas and oil pipelines, electric power plants above 250 megawatts and their dedicated transmission lines, new oil refineries or large expansions of existing facilities, and underground natural gas storage fields. EFSEC has been delegated authority by the U.S. Environmental Protection Agency to issue permits under the Federal Water Pollution Control Act and the Federal Clean Air Act for facilities under its jurisdiction.*	EFSEC provides a single permit authorization to all other state and local permits; incorporates equivalent requirement and reviews National Pollutant Discharge Elimination System (NPDES), Hydraulic Project Approval (HPA), 401 certification, and all other state and local permits and approvals. EFSEC is co-lead agency with USFS for preparation of the EIS.
	Section 309/ *Clean Air Act*	EFSEC would ensure the project complies with the act with regard to construction and operation activities.
	National Pollutant Discharge Elimination System (NPDES) Permits	EFSEC would review and issue the NPDES permit for discharge of hydrostatic test water.

Continued

Table 1-1. Permit, Approval, and Consultation Requirements for the Proposed Pipeline Project

Agency	Permit/Authority	Agency Action
Washington State Parks and Recreation Commission (WSPRC)	Easements	WSPRC would consider granting easements for WSPRC lands once the Governor approves the EFSEC Site Certification Agreement.
Washington State Department of Natural Resources (DNR)	Easements	DNR would consider granting easements for DNR lands once the Governor approves the EFSEC Site Certification Agreement.
All Landowners Along the Pipeline ROW		
Federal agencies, state and local agencies, private landowners	ROW ownership agreements	Each landowner along the alignment has the authority to enter into a ROW agreement with OPL. This agreement is a real estate transaction between owners. Federal agencies issuing such ROW agreements would do so through the BLM approval process and under NEPA. State, city, or county landowners will make their ownership ROW decisions outside of their permitting authority. EFSEC still retains all state and local permit authority for the project. Private landowners will decide on their own whether to sign agreements. OPL has condemnation authority over private lands but prefers to avoid that process by rerouting or signing an agreement.

is also a co-lead agency with the U.S. Forest Service in preparing the EIS. EFSEC is the sole agency authorized to permit the project. Other agency landowners who otherwise do not have permit authority have full ROW authority over their lands.

- **U.S. Forest Service.** The Department of Agriculture, U.S. Forest Service is the lead federal agency with EFSEC for developing this EIS. The Bureau of Reclamation, Department of the Army, U.S. Fish and Wildlife Service, and U.S. Army Corps of Engineers are cooperating agencies in the development of the EIS and will issue separate agency consents before the BLM issues a ROD for the right-of-way application.

1.6 RELEVANT FEDERAL AND STATE PLANS AND GUIDELINES

Along with the agency roles and decisions noted in the previous section, it is important to note federal and state plans, guidelines, and legislation that also are relevant to the proposal. These include:

- Mt. Baker-Snoqualmie National Forest Land and Resource Management Plan (USFS)
- Wenatchee National Forest Land and Resource Management Plan (USFS)
- Bureau of Land Management's Spokane District Management Plan (BLM)
- Snoqualmie Pass Adaptive Management Area Plan (USFS/USFWS)
- Columbia River Basin Ecosystem Management Project Eastside Plan (USFS/BLM)
- Bonneville Power Administration Standards and Regulations (BPA)
- Yakima and Columbia Basin Projects (BOR)
- Columbia National Wildlife Refuge Manual (USFWS)
- National Environmental Policy Act
- Washington State Environmental Policy Act
- State of Washington Growth Management Act
- State of Washington Shoreline Management Act

The proposal must be consistent with these plans, including any amendments and other plans or plan provisions they adopt. For example, the Northwest Forest Plan (NFP) seeks to conserve late-successional forest and foster healthy watersheds. It manages habitat for late-successional and old-growth forest-related species within the range of the northern spotted owl. The NFP amends all USFS land management plans and BLM resource management plans. NFP standards and guidelines apply to projects, permits, and special use authorizations in the geographic area covered by the USFS or BLM plan, including the proposed pipeline. Where standards and guidelines of the NFP conflict with those of individual plans, the more restrictive standard and guideline generally applies. The consistency of the proposal with relevant plans and guidelines, including local plans not listed above, is discussed in Chapter 3, Section 3.12, Land Use.

1.7 POTENTIAL USERS OF CROSS CASCADE PIPELINE PROJECT

The following list includes the potential users of the Cross Cascade pipeline project. The list consists of current shippers on the existing OPL pipeline plus other qualified shippers (marked with an asterisk) who meet the requirements for shipping on the pipeline but have not shipped product. Some of these shippers have committed to use the proposed pipeline if built.

Amoco Oil Company
ARCO Products Co.
Burlington Northern Santa Fe Railroad
Burns Brothers, Inc.
Cenex
Chevron USA Products
Conoco, Inc.
EOTT Energy
Exxon Company, U.S.A.
GATX Terminals Corp.
McCall Oil Company
Mobil Oil Corporation
* New West Petroleum
Northridge Petroleum Marketing, Inc.
Pilot Corporation
Puget Sound Energy
Rainier Petroleum
* Reinhard Petroleum LLC
Shell Anacortes Refining Company
Southern Counties Oil
Space Age Fuel
Tesoro Refining & Marketing
Texacon International Aviation
Time Oil Company
Tosco Corporation
Total Petroleum Inc.
Tower Energy
U.S. Oil & Refining Co.
United Airlines
Western Petroleum Company
Wilson Oil Inc.
* Fuel Defense Command Center

* Meets requirements for shipping, but has not shipped product

Chapter 2. Alternatives, Including the Proposed Action

2.1 INTRODUCTION

This chapter describes the applicant's proposal, including the location, capacity, right-of-way (ROW) needs, safety features, construction methods, mitigation measures, and costs for the project. Alternatives to the proposal and alternative project components such as options for approaching and crossing the Columbia River are also discussed. For planning and common reference purposes, a 30-year operating period is assumed. The actual operating life of the Cross Cascade pipeline would be indefinite.

Both the Washington State Environmental Policy Act (SEPA) and National Environmental Policy Act (NEPA) guidelines require that alternatives meeting the need for the proposal be considered. They also require that the impacts of these alternatives be compared with the impacts of not implementing the alternatives (No Action). As this chapter explains, several alternatives to the proposal have been evaluated such as other modes of petroleum product transport, demand management, and other pipeline routes. These alternatives have been evaluated and eliminated from further study based on a series of criteria and the Purpose and Need statement (see the section titled "Alternatives Considered but Eliminated from Detailed Study" later in this chapter). Therefore, this EIS evaluates the potential impacts of the proposed Cross Cascade pipeline as described in this chapter, and the No Action Alternative. No Action describes what would happen without the project, including what would happen to the Yellowstone and Chevron pipelines.

For an overview of the project features, see the Summary of this EIS. See the map supplement for maps of the segment numbers and mileposts used throughout this EIS in describing the pipeline corridor. OPL's Application for Site Certification (ASC), as amended in May 1998, is referenced where appropriate in this and other chapters of this EIS.

2.2 OVERVIEW OF EXISTING SETTING AND ACTION

If approved and permitted, the proposed 370 km (230-mile) pipeline[1] would originate on OPL's existing north-south lines just north of the King-Snohomish county line near Woodinville (Figure 2-1). The pipeline would extend to the east, crossing Snoqualmie Pass into Kittitas County generally following the same mountain passes as Interstate 90 (I-90). A storage and transfer terminal

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[1] Actual line length may approach 231 miles as minor centerline adjustments are made, but 230 miles is used in most cases for EIS purposes.

would be built at the town of Kittitas, adjacent to I-90. The line would cross the Columbia River downstream of Wanapum Dam in Grant County, before turning south to terminate at the Northwest Terminalling Company's existing terminal in Pasco, Washington.

2.2.1 Pipeline Capacity

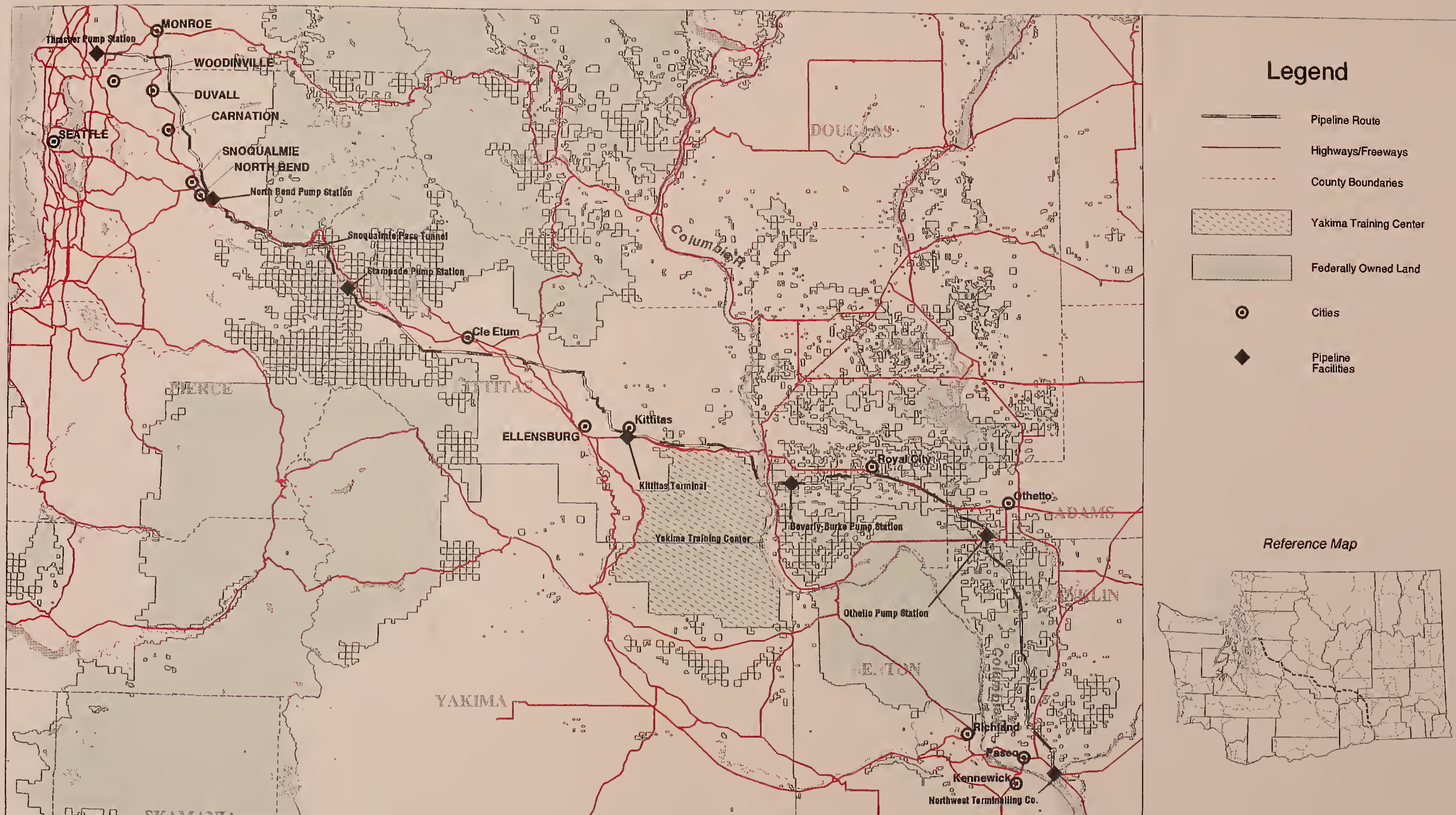
The pipeline would have an initial delivery operating capacity of 60,000 bbls (2,520,000 gallons) per day with the three proposed pump stations, and an ultimate capacity over time of up to 110,000 bbls (4,620,000 gallons) per day with all six pump stations built and operating. The additional three stations would only be constructed if demand continued to increase. The overall delivery capacity of the pipeline is focused on and limited to projected demand, not developing new markets or export. For example, assuming an initial demand of 60,000 bbls per day and a 1.5 percent compounded growth rate for a 30-year planning period, the pipeline would reach 94,000 bbls or 85 percent of its maximum capacity in 30 years and would be able to continue at that rate of growth for less than 50 years total. That same rate over a 50-year period would yield 126,000 bbls, which is in excess of the capacity of the line. (The existing north-south line is 35 years old and has reached capacity.)

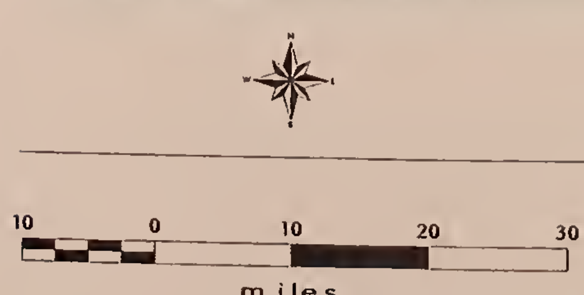
If the rate of compounded growth were 2 percent, transport demand would reach pipeline capacity within the first 30 years, when 109,000 bbls per day would be required. In either scenario, the project is responding to existing and currently projected shipping demand in Washington.

2.2.2 Right-of-Way Requirements

Approximately 176.2 km (109 miles) or 47 percent of the pipeline corridor would be located within existing cleared ROW (Table 2-1). About 90.1 km (56 miles) or 24 percent would be located immediately adjacent to existing cleared corridors. These areas are primarily roadways where existing utilities or roadway construction precluded placing the pipeline within the existing ROW. About 106.2 km (66 miles) or 29 percent would be located in new corridors.

Of the 370 km (230 miles) of pipeline, approximately 40.3 km (25 miles) of pipeline ROW are owned by federal agencies, 48.3 km (30 miles) of ROW are owned by state agencies, and King County owns approximately 3.2 km (2 miles) (Table 2-2). The majority of federal ownership along the proposed route is within lands managed by the U.S. Forest Service and the Bureau of Reclamation. The remaining 280.1 km (174 miles) of ROW are privately owned. The proposed pipeline would utilize two trail systems, the Cedar Falls Trail managed by King County and the John Wayne Trail owned by Washington State Parks.





PROJECT LOCATION

Cross Cascade Pipeline
Washington
FIGURE 2-1

Table 2-1. Summary of Right-of-Way Requirements by County, Proposed Pipeline Project (miles)

County	New Corridor	Adjacent to Existing Corridor	Inside Existing Corridor	Total Mileage
Snohomish	2.0	0.0	12.0	14.0
King	3.5	3.5	36.5	43.5
Kittitas	39.0	6.5	47.0	92.5
Grant	9.0	21.5	0.0	30.5
Adams	1.5	6.4	1.5	9.4
Franklin	11.0	18.0	12.1	41.1
Total	66.0	55.9	109.1	231.0

Source: OPL 1998.

Table 2-2. Summary of Right-of-Way Ownerships

Ownership	Miles*	Percentage
Federal Agencies:		
U.S. Forest Service	11.34	4.9
Bureau of Land Management	0.54	0.2
Bureau of Reclamation	12.42	5.4
U.S. Fish & Wildlife Service Columbia National Wildlife Refuge	0.45	0.2
Total Federal Ownership	24.75	10.7
State Agencies:		
Natural Resources	7.55	3.3
Parks & Recreation	19.76	8.6
Department of Fish and Wildlife	0.22	0.1
Total State Ownership	29.73	12.9
Local Agencies:		
King County Roads	1.51	0.7
Private Ownership:		
Private Owners	175.04	75.9
Total Miles	230.70	100

Source: OPL 1998.

* Numbers are approximate and not the result of boundary survey.

2.3 PROPOSED ACTION: PETROLEUM PRODUCT PIPELINE

2.3.1 Ability to Meet the Purpose and Need

The proposal's ability to meet the Purpose and Need described in Chapter 1 is discussed below.

- **Cost-Effectiveness**: The new pipeline would transport petroleum products from refineries in Anacortes (Marche Point) and Whatcom County (near Cherry Point) to central and eastern Washington at a lower cost than the existing trucking and barging system, an estimated $1.50 per barrel (OPL 1998) to Pasco. This is in response to shippers' request for a system costing less than truck or barge. Alternatives that cost more than the existing systems would not be used by shippers and are therefore not cost-

effective. Various alternative routes and alternative crossings offer a range of cost-effectiveness at lower cost than existing trucking and barging.

- **Efficiency:** The proposal would be more efficient than the existing system because it involves fewer transfers and is more reliable. It would avoid the need to offload product from one transport mode to another, such as the existing pipeline onto tanker trucks for shipment across the Cascades. Construction of a new pipeline would eliminate tanker truck transport across Snoqualmie and Stevens Passes and establish a system to pick up petroleum product in Kittitas, rather than trucking it from Seattle across the passes. More significantly, it would avoid transfers from pipeline to Portland terminals to river barge to Pasco terminals, or from ocean barges to Portland onto river barges, or from Puget Sound barges to Harbor Island. Conversion and transfer from one mode of shipment to another is not as efficient as a single transport mode (i.e., the new pipeline). Winter time trucking across Snoqualmie and Stevens Passes can be delayed from many hours to days. The proposal would eliminate these inefficient delays. Pipelines are also a more efficient transport system in energy per ton mile than trucking or than shipping with multiple transfers.

- **Environmental Soundness:** The proposal would reduce the risk of accidental spills during the transfer from one mode of shipment to another by reducing such transfers. The proposal would reduce the risk of spills from barges on the Columbia River and Puget Sound and tanker trucks along the I-90 corridor. It would provide a new pipeline system with spill detection. (Spill risk is discussed in detail in Section 3.18, Health and Safety, and Appendix A.) The proposal would create a risk of spill along the new pipeline corridor which does not now exist and would require 370 km (230 miles) of ROW, 29 percent of which is new and not adjacent to existing ROW. This new pipeline risk can be compared to the risk of barge, ship, and tanker truck spill and accidents which would continue to increase over time with increasing numbers of trips if the pipeline is not constructed. Spills and accidents are predicted in this EIS with and without the project.

- **Meeting Long-Range Needs:** The proposal would be sized to handle all of today's product needs anticipated from western Washington refineries and future needs for at least 30 years at a 1.5 percent annual growth rate.

2.3.2 Description of Corridor Location and Project Features

This section provides an overview of the location and characteristics of the pipeline corridor, pump stations, Kittitas Terminal, and the terminus for the proposed pipeline. Additional details are provided in OPL's amended ASC submitted to the Washington Energy Facility Site Evaluation Council (EFSEC) in May 1998.

2.3.2.1 Pipeline Characteristics

The coated steel pipeline would be 35.6 centimeters (cm) (14 inches) in diameter from mile post (MP) 0 to 124.0 (the Thrasher Station to the Kittitas Terminal). The diameter would change to 30.5 cm (12 inches) from MP 124.0 to 231.0 (the Kittitas Terminal to the Northwest Terminalling bulk storage facility in Pasco).

The pipeline would be welded with a minimum yield strength of 52,000 pounds per square inch (psi) and a minimum operating pressure of 1,440 psi. Wall thickness would be a minimum of 0.7 cm (0.281 inch) for the 35.6 cm (14-inch) line, and 0.6 cm (0.250 inch) for the 30.5 cm (12-inch) line. Greater wall thicknesses would be used for added safety at the pump stations, road crossings, railroad crossings, on bridges, and at stream crossings. The pipe would also be protected at appropriate locations by being coated with a protective layer such as concrete, powercrete, high-density polyethylene, and/or CT urethane. Cement coating at stream crossings provides protection and weight to avoid buoyancy. The pipeline would also have a cathodic protection system (a small electrical charge applied to the pipeline) to provide corrosion protection.

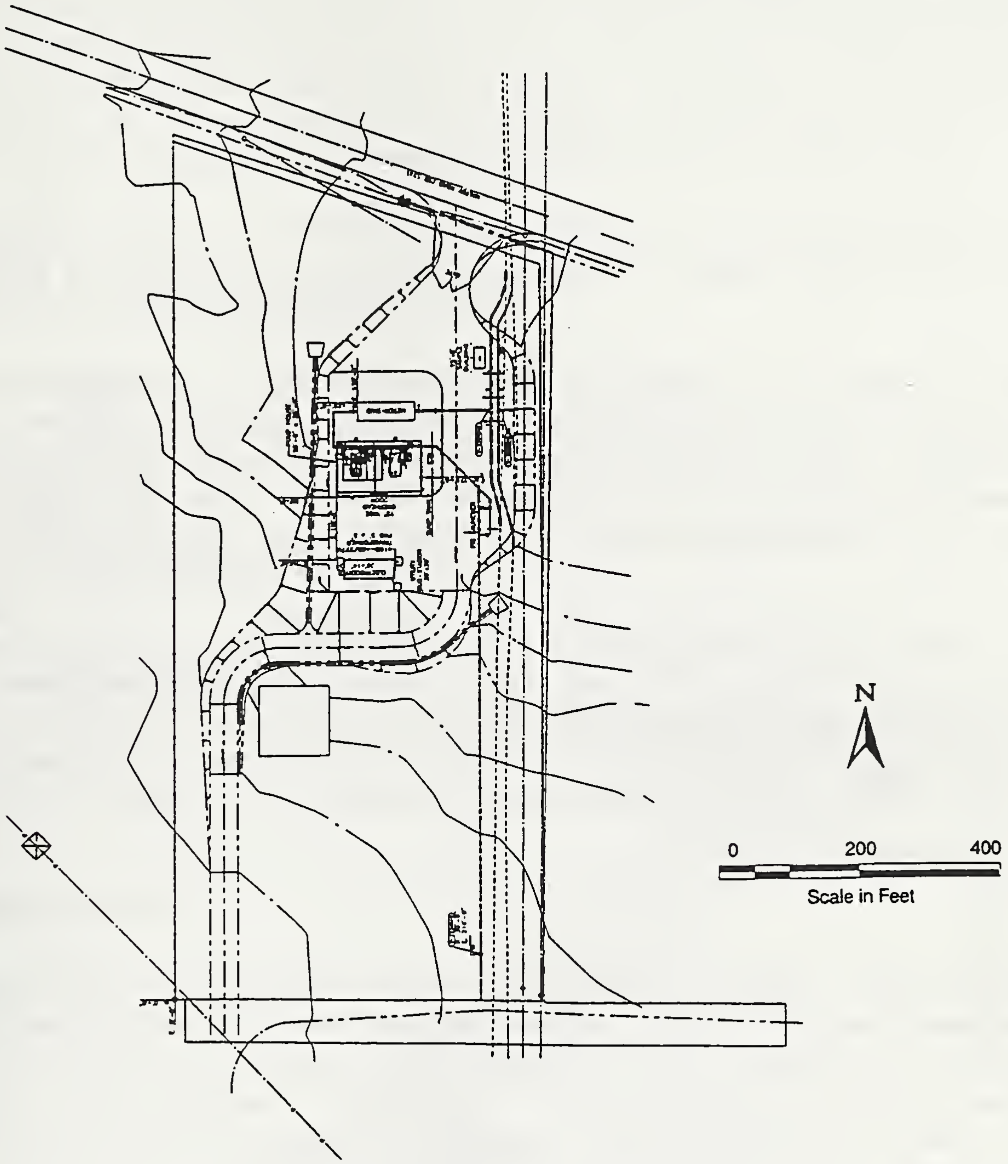
2.3.2.2 Pump Stations

Six pump stations would be located along the corridor in Segments 1 (Thrasher Station), 16 (North Bend Station), 25 (Stampede Station), 31 (Kittitas Station), and 34 (Beverly-Burke and Othello Stations) (see Figure 2-1 for station locations). Three of these stations (Thrasher, North Bend, and Kittitas) would be constructed initially, and the others would be constructed over time to increase capacity as demand for more product increases.

The Thrasher Pump Station would be located on about 1.5 hectares (ha) (3.7 acres) and each of the other pump station sites would be about 0.4 to 0.8 ha (1 to 2 acres) in size. Part of each site would be cleared. The Thrasher, North Bend, and Stampede Pump Stations would be enclosed in a building to protect the facility and provide noise abatement. The Kittitas, Beverly-Burke, and Othello Pump Stations would not be enclosed. The stations would be fenced and gated to limit access. These pump stations would be remotely controlled from the pipeline control center and can also be manually operated onsite.

The Thrasher Station (MP 0.0) would be located in south-central Snohomish County, on 46th Avenue and north of 212th Street SE, north of the existing OPL Woodinville Station (Figure 2-2). It would be partially located within existing cleared Puget Sound Energy ROW. Approximately 0.4 ha (1 acre) would require clearing for the pump station. The topography of the site is gently rolling. Surrounding land use is rural residential.

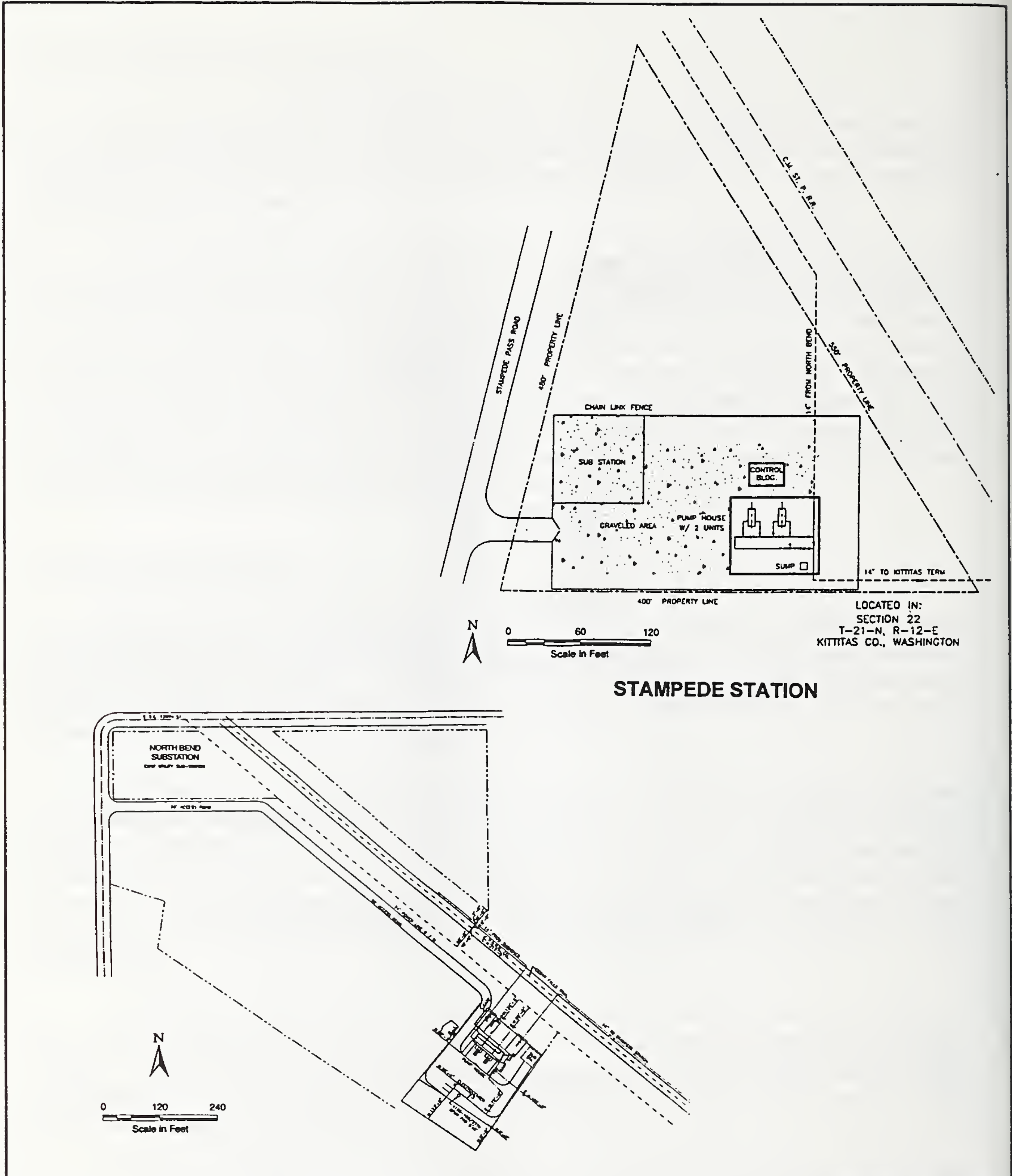
The North Bend Station (MP 35.3) would be located on about 0.4 ha (1.1 acres) south of SE 120th Street and south of the Cedar Falls Trail (Figure 2-3). It would be in a field currently covered with grasses and blackberry bushes used for grazing adjacent to the Cedar Falls Trail ROW. Brush clearing would be required for the pump station. The pump station site would be set back approximately 12.2 m (40 feet) from the edge of the trail, and existing vegetation in the setback area



THRASHER STATION

Source: OPL 1998.

THRASHER STATION



Source: OPL 1998.

NORTH BEND STATION AND STAMPEDE STATION

(blackberry bushes) would screen the station from trail users. Surrounding land uses are urban and rural residential. The proposed site is near an existing Puget Sound Energy electrical substation.

The future Stampede Station (MP 67.1), proposed for later construction if needed, would be located near (east of) Stampede Pass Road, east of Lake Easton, in Kittitas County (Figure 2-3). It would be in a partially forested meadow at an elevation of about 731.5 m (2,400 feet). The terrain is relatively flat and minimal clearing would be required. Although the station might not be constructed initially, the block valves that are part of the station would be installed. The proposed site is on private land purchased by OPL and near an AT&T fiberoptic regeneration station.

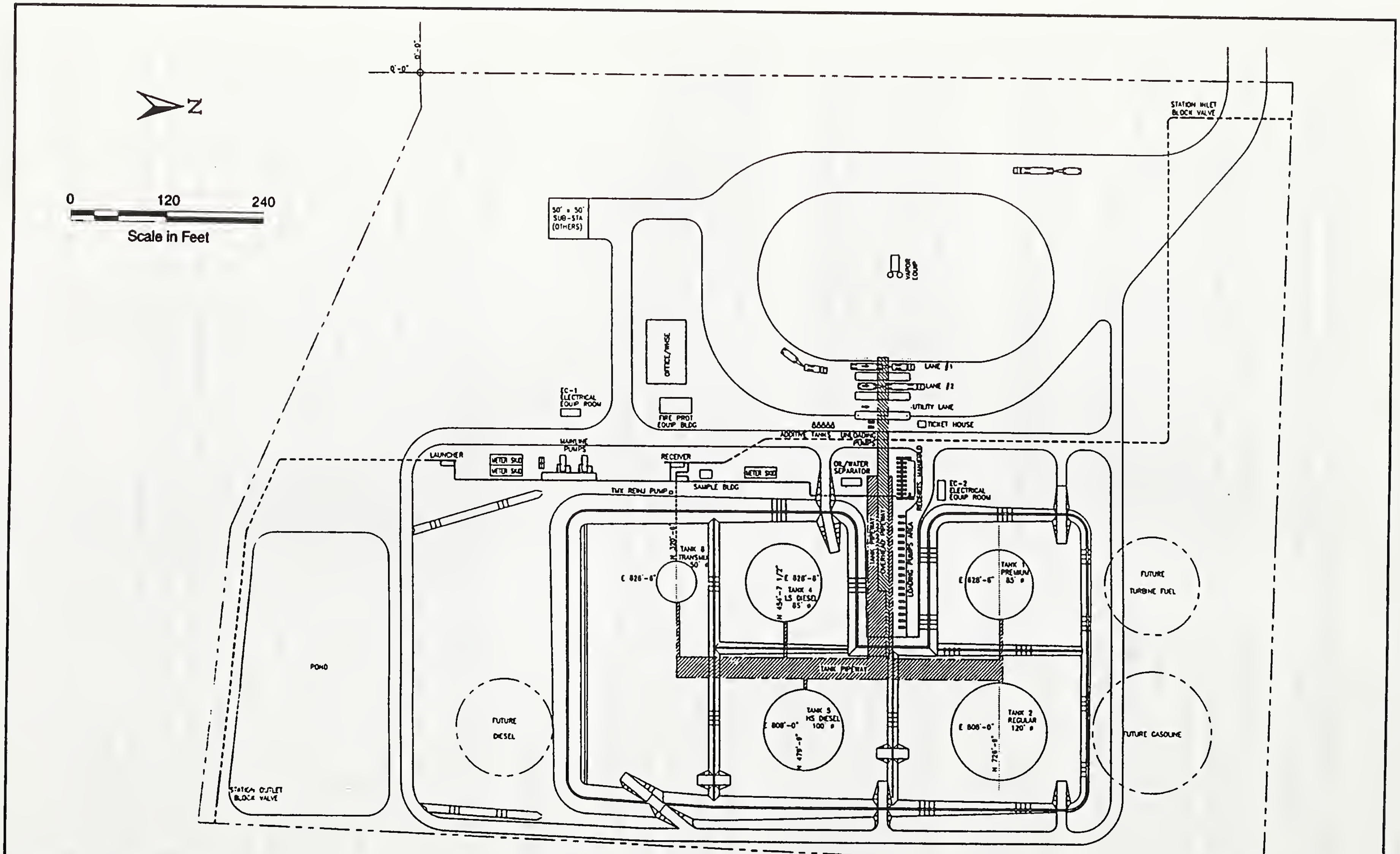
The Kittitas Station (MP 124.0) would be located at the 10.9 ha (27-acre) Kittitas Terminal at the northeast intersection of I-90 (Exit 115) and Badger Pocket Road (Figure 2-4). It would be on land that is currently used for irrigated agriculture.

The future Beverly-Burke Station (MP 154.1), proposed for later construction if needed, would be located near (south of) Beverly-Burke Road in Grant County about 6.4 km (4 miles) east of the Columbia River. It would be in an area of rangeland that is not currently cultivated. Some brush clearing would be required for construction of the pump station. The site is at an elevation of 335.3 m (1,100 feet). Block valves would be installed during initial construction of the pipeline to accommodate the future installation of the pump station.

The future Othello Station (MP 189.9), proposed for later construction if needed, would be located about 9.7 km (6 miles) southwest of Othello and 670.6 m (2,200 feet) north of State Route 24 in Adams County. The station would be at an elevation of about 365.8 m (1,200 feet) on agricultural land that is currently being farmed. Block valves would be installed during initial construction of the pipeline to accommodate the future installation of the pump station.

2.3.2.3 Block Valves

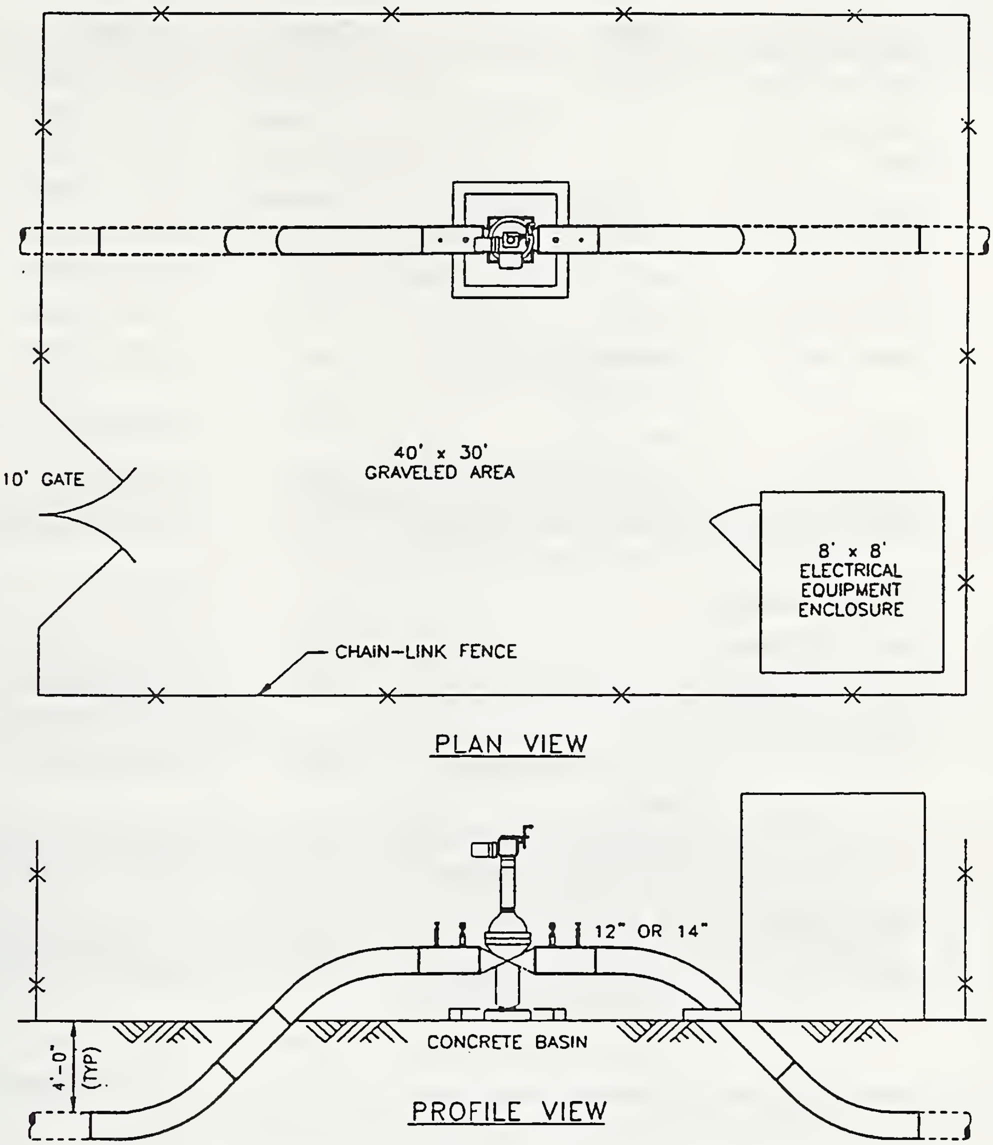
About 29 block valves would be installed along the pipeline corridor. A typical block valve layout is shown in Figure 2-5. Valve locations are shown in Table 2-3. These valves would be remotely controlled from the pipeline control center and can also be manually operated as they are on the surface. They would enable an automatic response to any detected rupture or hole in the pipeline and would limit the amount of product released. Each block valve site would be a fenced area of approximately 9.1 by 12.2 m (30 by 40 feet). Facilities at the site would consist of a 2.4 by 2.4 m (8- by 8-foot) control building, 8-foot by 8-foot valve vault or aboveground valve, and a power service pole. Utility service to the pump stations would include water, sewer, and electricity, which would be provided by local utilities. In cases where no sewer is available, a septic system would be installed. Power would be brought to the site from adjacent electric utility service distribution lines. Most sites are within one-tenth mile of existing power lines. In the event that commercial power is not readily available, a stored-energy actuator would be used on the block valve in lieu of a motor-operator, and power for the electronics would be developed onsite using a suitable alternative energy source such as solar panels.



Source: OPL 1998.

KITTITAS TERMINAL SITE PLAN

Cross Cascade Pipeline
Washington



Source: OPL 1998.

TYPICAL BLOCK VALVE LAYOUT

Cross Cascade Pipeline
Washington
FIGURE 2-5

Table 2-3. Block Valve Locations, Proposed Pipeline Project

Valve No.	Purpose*	Location	County	Sec/Tw/Rn	Approx. MP
1	Thrasher Station	Maltby Road	Snohomish	SEC21/T27N/R5	0
2	Snoqualmie River, West	Lake Crest/High Bridge Rd.	Snohomish	SEC26/T27N/R6E	8.10
3	Snoqualmie River, West	West Side of Hwy 203	Snohomish	SEC25/T27N/R6E	9.30
4	Cherry Creek	North Side of Cherry Creek Road	King	SEC9/T26N/R7E	16.19
5	Cherry Creek	South of road on edge of property line	King	SEC14/T25N/R7E	23.42
6	Tolt River	Top of hill	King	SEC14/T25N/R7E	24.56
7	Tolt River	East side of Tokul Creek Road	King	SEC20/T24N/R8E	31.86
8	Snoqualmie River	North of trestle bridge; north of Reinig Road	King	SEC29/T24N/R8E	34.06
9	North Bend Station		King		37.32
10	North Bend Station		King		37.34
11	S. Fork Snoqualmie River, West	East side of SE 145th SE	King	SEC23/T23N/R8E	39.42
12		North side of Homestead Road	King	SEC28/T23N/R9E	44.29
13		Near Exit 47 of I-90; north side of Homestead Road[1]	King	SEC13/T22N/R10E	54.80
14	Stampede Station	Stampede Pass Road	Kittitas	SEC22/T21N/R12E	67.07
15	Cabin Creek	West side of Monihan Road; 35 meters south of BNRR	Kittitas	SEC9/T20N/R13E	73.90
16		West side of Cle Elum Ridge	Kittitas	SEC4/T19N/R15E	87.56
17	Yakima River, East	Between I-90 and Thorpe Prairie Rd.	Kittitas	SEC10/T19N/R16E	95.26
18	Yakima River, West	30 meters east of Highway 10	Kittitas	SEC11/T19N/R16E	96.19
19	Currier Creek/North Branch Canal	East Side of Evans (Robbins) Road	Kittitas	SEC27/T19N/R18E	108.73
20	Kittitas Station	Badger Pocket Road	Kittitas	SEC12/T17N/R19E	123.89
21	Kittitas Station		Kittitas		124.09
22	Park Creek/High Line Canal	West side of Stevens Road	Kittitas	SEC14/T17N/R20E	129.82
23	Columbia River, West	West Side of Huntzinger Rd.[2]	Kittitas	SEC18/T16N/R23E	148.39
24	Columbia River, East	East of Highway 243[3]	Grant	SEC21/T16N/R23E	150.35

Table 2-3. Block Valve Locations, Proposed Pipeline Project

Valve No.	Purpose*	Location	County	Sec/Tw/Rn	Approx. MP
25	Beverly Burke Station	Beverly Burke Rd.	Grant	SEC24/T16N/R23E	154.08
26	Unnamed Stream, West	Near Highway 26[4]	Grant	SEC35/T16N/R27E	178.53
27	Lower Crab Creek, North	South side of Highway 26[4]	Grant	SEC8/T15N/R28E	181.69
28	Othello Station		Adams	SEC3/T15N/R27E	189.15
29	Pasco Metering Station		Franklin		231.01

Source: OPL 1998.

* Block valves will be located at pump stations and at crossings of large rivers or streams that have a large number of water withdrawals.

Notes: administered federal lands
[1] U.S. Forest Service
[2] Bureau of Land Management
[3] Bureau of Reclamation
[4] U.S. Fish and Wildlife Service

Block valves are placed at low points near environmentally sensitive areas where potential spill volumes can be reduced. Block valve placement can reduce spill volumes due to pipe rupture. They are expensive and, as a valve fitting, provide another potential leak point (for small leaks). Numbers and placement of valves involve a balance between cost, risk, and impact. The volume of product per mile of 12-inch- and 14-inch-diameter lines is approximately 2,900 and 4,000 bbl, respectively.

Agencies have indicated concern about potential product spills into Keechelus Lake (MP 59.5 to MP 65.5) and requested installation of another block valve between the Tinkham Road valve (#13 at MP 54.8) and the Stampede Pass Pump Station (#14 at MP 67.07) to reduce the size of a potential spill. Thus, it is recommended that OPL install another block valve west of MP 59 to meet this request and reduce the quantity of a potential spill by reducing potential spill volume and reducing hydraulic head pressure along the lake.

2.3.2.4 Kittitas Terminal

The Kittitas Terminal (MP 124.0) would occupy about 10.9 ha (27 acres) currently used for irrigated agriculture north of and adjacent to I-90 and east of Badger Pocket Road (Figures 2-1 and 2-4). The terminal would ultimately have nine aboveground liquid petroleum storage tanks 14.6 m (48 feet) high and 30.5 to 45.7 m (100 to 150 feet) in diameter, with a total storage capacity of

36,120,000 gallons of product. In addition, one 420,000 gallon transmix/relief tank (9.1 m [30 feet] high and 15.2 m [50 feet] in diameter) would also be included. The terminal also includes truck loading racks and parking for tanker trucks.

Initial onsite construction of the Kittitas Terminal (Figure 2-4) would include the construction of:

- five large storage tanks (two regular gasoline, one premium gasoline, one LS diesel, and one HS diesel),
- one small transmix tank and one small ethanol tank,
- an office/warehouse building with restrooms,
- a control building,
- a 45.7 by 45.7 m (150- by 150-foot) substation,
- three loading racks,
- two metering facilities,
- an oil/water separator,
- a stormwater basin measuring 52.1 by 106.7 by 0.9 m (171 by 350 by 3 feet deep), and
- connections to public water and sewer systems.

As demand required, the remaining large diesel tank, turbine fuel tank, and gasoline tank would be added for ultimate buildout.

2.3.2.5 Pasco Delivery Facility

The Pasco Delivery Facility would occupy about 0.4 ha (0.9 acre) near the intersection of U.S. Highway 12 on Sacajawea Park Road, across the road from the Northwest Terminalling Facility in Pasco. The site is level with minimal vegetation and is now unused. The facility would have metering equipment, a 2.4 by 12.2 m (8- by 40-foot) sample building, a 3.7 by 10.7 m (12- by 35-foot) control building, and other equipment. Two lines would connect to the Northwest Terminalling Facility, one for diesel fuel and one for gasoline.

2.3.2.6 SCADA System

The pipeline would be continuously monitored (24 hours per day for 365 days per year) by operational staff at the OPL Renton facility using a detection system called a Supervisory Control and

Data Acquisition (SCADA) system. This system detects anomalies in the flow of product through segments of the pipeline, based on rapid drops in pressure or other parameters (such as temperature or product characteristics) within the detection limits of the system. If an anomaly is detected by the system, the pipeline can be shut down automatically or by direction from staff until that portion of the pipeline can be inspected for leaks and any necessary repairs can be made. The line can be shut down in 5 minutes or less upon activation of block valve closure. There are limits to the leak size detectable by the system. For example, a leak of less than 1 percent of flow (600 bbls per day [25,200 gallons]) may not be immediately detectable by the system. Such leaks would only be detected by fluid balance measurements, routine visual inspections, or citizen reporting.

2.3.3 Construction

2.3.3.1 Pipeline Overview

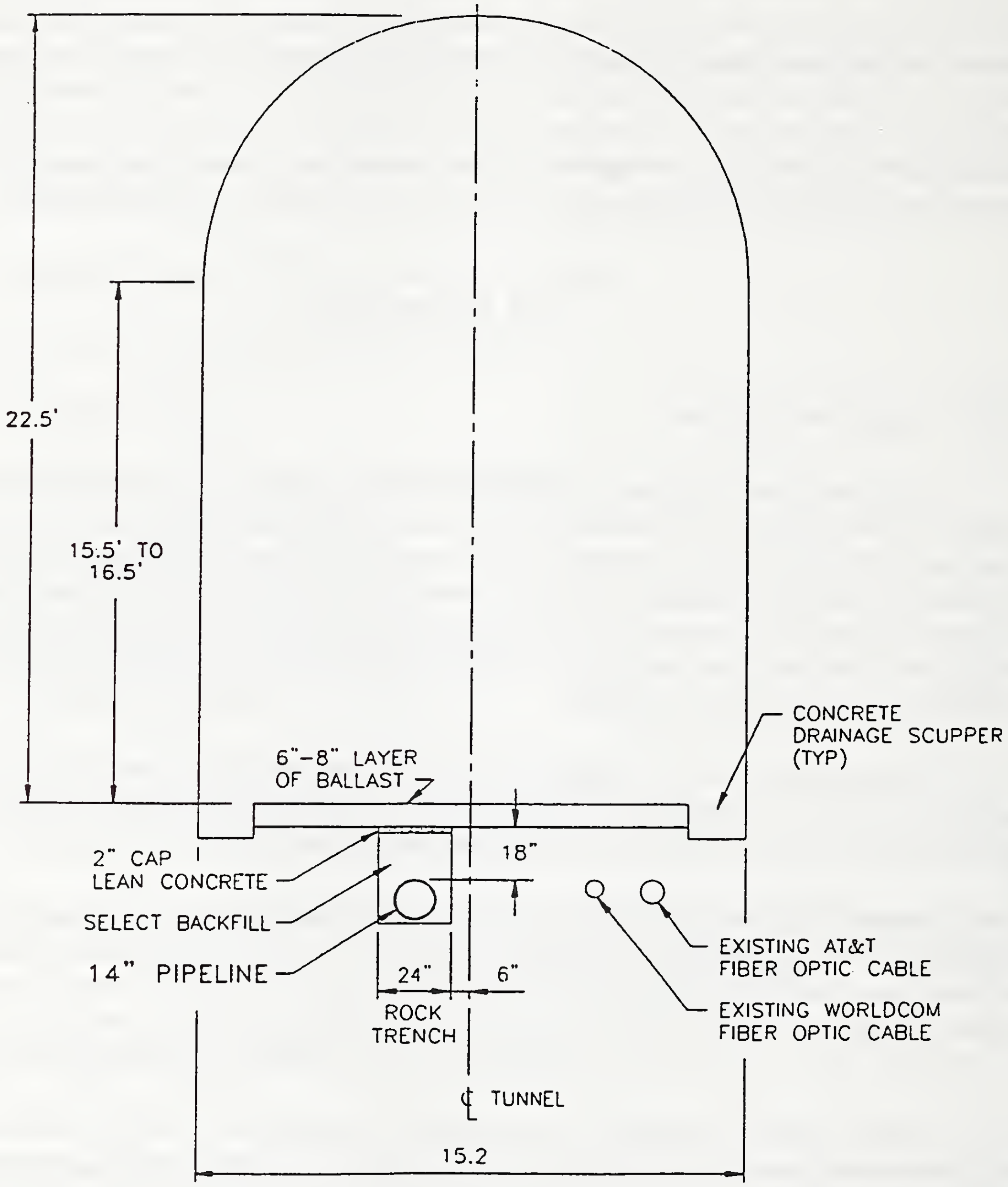
Construction Progress. Construction of the pipeline would take about 1 year and cost slightly more than $105 million. The anticipated duration of pipeline construction at any one location along the corridor would be no more than 10 days except for larger water crossings where more time is needed. Construction progress would be slowest at road and waterway crossings, where several days may be required to complete the crossing by either boring or trenching. Construction progress in flat open terrain might be completed in as little as 2 to 3 days. Construction would start and end in early spring, as previously proposed.

OPL proposes to have construction occur in three spreads, and a variety of crews within those spreads, to enable construction to occur concurrently at various places along the pipeline. Table 2-4 shows timing restrictions (construction windows) for the project.

Spread 1 is generally comprised of the western portion of the pipeline and includes three counties: 22.5 km (14.0 miles) in Snohomish County, 29.6 km (18.4 miles) in the northeastern portion of King County, and 74.0 km (46.0 miles) in the central portion of Kittitas County. It would require a peak construction workforce of 375. Under favorable weather conditions, construction would occur at a rate of 3.1 to 3.7 km (1.9 to 2.3 miles) per day and would take a total of about 1.75 months.

Spread 2, which is generally the central portion, is comprised of the mountainous segment of the pipeline, buried within the Snoqualmie Pass Tunnel (Figure 2-6) over Snoqualmie Pass, as well as major river crossings. It includes 39.6 km (24.6 miles) in the eastern portion of King County and 29.6 km (18.4 miles) in the western portion of Kittitas County. It would require a peak workforce of 159 workers and would be constructed at a rate of 0.6 km (0.4 mile) per day for a total of 4.33 months.

Spread 3, the eastern portion of the pipeline, includes 45.2 km (28.1 miles) in the eastern part of Kittitas County, 49.1 km (30.5 miles) in Grant County, 15.1 km (9.4 miles) in Adams County, and 66.1 km (41.1 miles) in Franklin County for a total of 175.5 km (109.1 miles). It would require 375 workers during the peak and would be constructed at a rate of 3.1 to 3.7 km (1.9 to 2.3 miles) per day for a total of about 2 months.



Source: OPL 1998.

SNOQUALMIE PASS TRAIL TUNNEL
TUNNEL CROSS SECTION - LOOKING EAST

Cross Cascade Pipeline
Washington
FIGURE 2-6

Table 2-4. Exclusionary Periods for Construction and Operational Activities for the Proposed Action

Resource Area	Restriction	Exclusionary Period
Construction:		
Wildlife and T&E Species (peregrine falcon)	Do not construct near Columbia River peregrine falcon nesting areas without conducting clearance surveys.	February - July
Wildlife and T&E Species (sandhill crane)	Do not construct within areas mapped by WDFW as priority sandhill crane habitat unless authorized by WDFW.	Early March - mid-May, mid-September - early November
Wildlife and T&E Species (general birds)	Limit vegetation clearance for birds protected under the Migratory Bird Treaty Act unless clearance surveys are done within 10 feet of clearing areas and approved by agencies.	March 15 - July 15
Wildlife and T&E Species (raptors)	Do not construct within 0.25 mile of raptor nests unless clearance surveys are done.	March 15 - July 15
Wildlife and T&E Species (northern spotted owl)	Prohibit construction within the range of the northern spotted owl within 0.25 mile of suitable nesting habitat unless surveys have been completed and approved by the USFWS.	March 15 - August 1
Wildlife and T&E Species (northern spotted owl)	Prohibit blasting during the northern spotted owl nesting season anywhere within USFS lands unless approved by the USFWS.	March 15 - August 1
Wildlife and T&E Species (burrowing owl)	Do not construct within 0.25 mile of active burrowing owl nest sites.	March 15 - August 15
Wildlife and T&E Species (sensitive species)	Do not clear during the spring nesting season for sensitive species (i.e., northern goshawks, prairie falcons, ferruginous hawks, red-tailed hawks, burrowing owls, long-billed curlew, and sandhill cranes), without clearance surveys.	April 1 - July 15
Wildlife and T&E Species (marbled murrelet)	Prohibit construction within the range of the marbled murrelet unless approved by the USFWS on a case-by-case basis.	April 1 - September 15
Wildlife and T&E Species (marbled murrelet)	Prohibit blasting anywhere within USFS lands during the marbled murrelet nesting season unless approved by the USFWS.	April 1 - September 15
Fisheries	Do not construct in the Columbia River.	April 1 - October 15
Fisheries	Do not construct in the Keechelus Lake Tributaries.	August 16 - July 31
Fisheries	Do not construct in Cabin Creek, Big Creek, or Little Creek.	September 1 - June 30
Fisheries	Do not construct in Little Bear Creek.	October 1 - June 14
Fisheries	Do not construct in stream crossings in Snohomish County.	October 1 - June 14
Fisheries	Do not construct in stream crossings in Kittitas County.	October 1 - June 14

Continued

Table 2-4. Exclusionary Periods for Construction and Operational Activities for the Proposed Action

Resource Area	Restriction	Exclusionary Period
Fisheries	Do not construct in stream crossings in Grant County.	October 1 - June 30
Fisheries	Do not construct in stream crossings in Franklin County.	October 1 - June 30
Fisheries	Do not construct in stream crossings in Adams County.	October 1 - June 30
Fisheries	Do not construct in the Yakima River or Swauk Creek.	October 1 - August 31 (October 1 - September 14 preferred)
Wildlife and T&E Species (snakes)	Do not disturb snake hibernacula, coordinate with WDFW and USFWS where this conflicts with other species.	October 15 - May 1
Fisheries	Do not construct in stream crossings in King County.	October 16 - June 14
Wildlife and T&E Species (bald eagle)	Do not construct within 100 m of Snoqualmie, Tolt, South Fork Snoqualmie, Yakima, or Columbia Rivers; Keechelus Lake; or lower Crab Creek unless daily clearance surveys are done to determine no wintering bald eagles are present within 100 m of construction or 1,000 m of blasting.	November 1 - March 15
Operation:		
Wildlife and T&E Species (nesting birds)	Do not conduct tree cutting maintenance during the nesting season unless clearance surveys are conducted to verify no nests are present.	March 15 - July 15
Wildlife and T&E Species (wintering deer)	Do not drive through wintering deer range.	When snow cover averages greater than 2 feet

The construction time frame on any spread would exceed these schedules if certain construction windows, across streams, for example, cannot be met in the time period indicated.

Staging Areas and Crew Yards. Pipeline would be transported by rail to four or five pipe staging areas measuring approximately 6.1 to 12.1 ha (15 to 30 acres) each. Pipe staging areas are locations where the pipe joints can be unloaded from railcars and temporarily stored while they await distribution (stringing) along the ROW. Potential staging areas near active or to-be-refurbished rail sidings include Everett, Easton, Ellensburg, Royal City, and Pasco. The final selection of staging sites would be based on the condition of the rail sidings, the availability of land to stack pipe, the proximity to an improved highway, and location relative to the construction spread. Pipeline would be transported daily by tractor trailer to be placed along trenches for assembly and carried to the trench by pipe-laying equipment.

In addition to pipe staging areas, contractors would have construction crew staging yards measuring 4.1 to 8.1 ha (10 to 20 acres) for office trailers and workcrew parking. The contractors would locate and make arrangements to secure a yard area for use by construction crews; it is anticipated that the contractors would seek disturbed (developed, paved, etc.) sites. This area would

be used to locate office trailers, storage trailers, and fuel tanks, and would operate as an assembly point for construction crews to meet prior to proceeding on to the ROW.

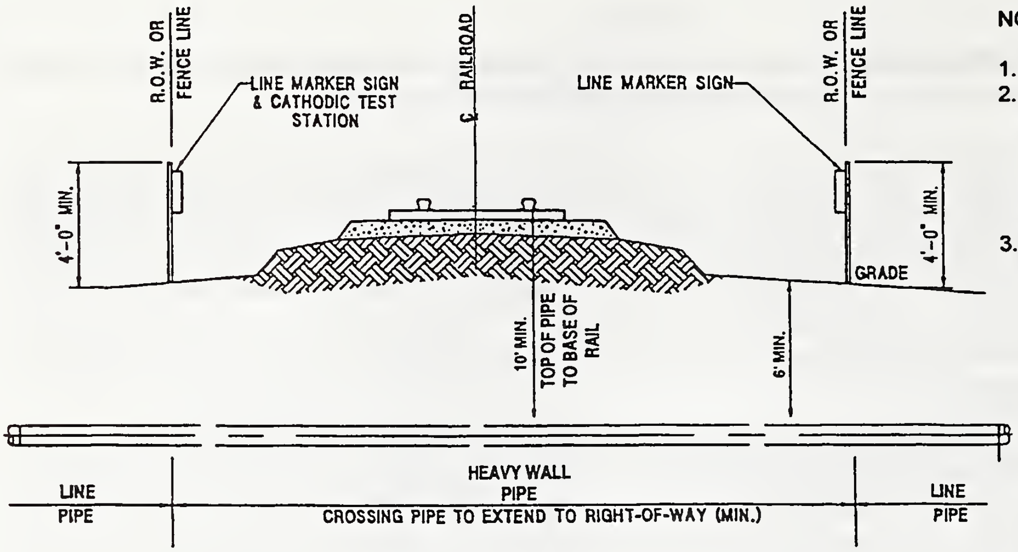
Construction Corridor and Pipe Depth. The construction would occur within a pipeline corridor that is 18.3 m (60 feet) wide or less, depending upon the width of the available corridor (such as in Tinkham Road which is a 3.1 to 6.1 m [10- to 20-foot] wide U.S. Forest Service road). In general, a 60-foot construction easement is required to allow for the following:

Stockpile excavated material	4.6 m (15 feet)
Excavated trench	1.5 m (5 feet)
Fabricated pipe string	1.5 m (5 feet)
Construction equipment maneuvering	4.6 m (15 feet)
Construction vehicle traffic lanes	6.1 m (20 feet)
Required construction easement	18.3 m (60 feet)

The pipeline would be placed a minimum of 3.1 m (10 feet) below the six major riverbed crossings (from the top of the pipe to the riverbed), 1.2 m (4 feet) deep at other creek and water crossings, 1.8 m (6 feet) (from the top of the pipe to the ground) below railroad crossings (Figure 2-7), and 1.2 m (4 feet) below agricultural and other lands (OPL 1998). River and stream crossings under any conditions would be placed a minimum of 0.6 m (2 feet) below projected maximum scour depths. Specific scour depth potential would be determined during design.

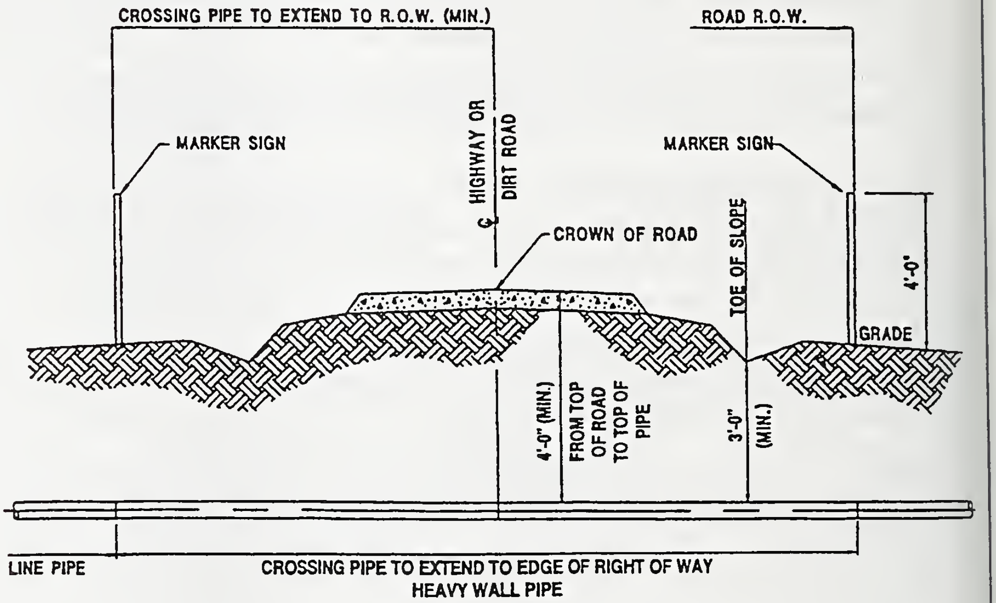
Welding and Pipe Trench. Sections of coated steel pipeline measuring 12.2 m (40 feet) would be welded together (on level terrain) in 182.9 to 274.3 m (600- to 900-foot) pipeline sections next to the open trench using at least four layers of full-penetration arc welds. Shorter segments would be handled at crossings or steep terrain. The welds would be X-rayed and coated, and the pipeline would then be placed in the trench. The pipe would be placed in a bed of soft material (crushed rock, sand, and other materials), comprising at least 15.2 cm (6 inches) of material in the bottom of the trench (below the pipe) and covering the pipe to at least a foot, before backfill material is placed over it. Trench plugs would be used as necessary to prevent flow of water along sloped portions of the pipeline trench. In addition, a trench bottom sealing material, trench lining, or construction techniques such as a combination of compaction materials, would be used in certain wetland areas (see Wetlands) to avoid draining a perched wetland. The site would then be returned to its original contour, mulched, and reseeded or revegetated as soon as possible after construction is completed (from a few days for reseeding up to 6 months for more difficult revegetation). Areas would be reseeded or replanted as necessary until restoration was complete.

Access. No new access roads would be constructed or maintained for the proposed petroleum product pipeline. Existing roads would be used wherever possible. The width or quality of existing roadbeds would not be improved unless it became part of an agreement with the U.S. Forest Service or other landowner. In the event that a closed road is temporarily opened for construction, it would again be closed upon completion of construction. Access via roads closed in winter would be via snowmobile. Existing open roads would remain open after construction was completed.



NOTE:

1. Pipe to be factory coated
2. All bored crossing pipe shall have a minimum of 1" concrete coating for protection during insertion. Pipe for open cut crossing does not require concrete coating.
3. Cover dimensions are in accordance with API RP 1102.



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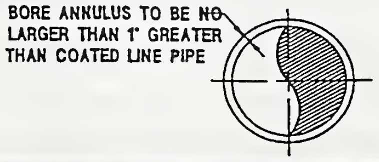


Source: OPL 1998.

TYPICAL RAILROAD CROSSING

Cross Cascade Pipeline
Washington
FIGURE 2-7

Signage and Ground Monitoring. Warning signs would be frequently placed to mark the location of the pipeline at fence lines and trails. The intent is that a person standing on the pipeline would be able to see a warning sign in either direction. Stream gauges would be installed on the pipe to detect compression and tension due to soil movement. Ground displacement and groundwater level would be monitored in situ to detect erosion or potential slide problems.

Watercourse Crossings. The pipeline would cross many areas requiring specialized construction approaches, including about 78 wetlands and nearly 300 streamcourses (rivers, streams, and canal crossings). Crossing methods include boring under streams, cutting through streams, and bridging over streams. Watercourse crossings that require special construction techniques due to physical conditions are summarized in Table 2-5. River crossings would include two for the Snoqualmie River, two for the South Fork Snoqualmie River, two channels across the Tolt River, once across the Yakima River, and once across the Columbia River. Buttresses would be installed at the toe of slopes where appropriate, to prevent slope movement. Alternatively, slope grades could be flattened.

Several methods for crossing sensitive areas would be used. Most river and stream crossings would use diversion and trenching methods, such as stream diversion and trenching, flume diversion and trenching, and channel isolation and trenching (Figures 2-8 and 2-9). Typically, wet trenching (cutting through streams) would be used for streams with low flows and diversional trenching (diverting flows before cutting) would be used for larger streams. The technique would depend on the amount of water to be managed.

Horizontal directional drilling is planned for the Columbia River, and as an alternative method for the Snoqualmie River if the bridge crossing cannot be used. Drilled crossings avoid instream impacts but require much shoreline area disturbance. Drilled crossings require a minimum of a 30.5 by 76.2 m (100- by 250-foot) area on the drilling side of the crossing and 53.3 by 30.5 m (175 by 100 feet) on the opposite side to prepare and pull the pipe. The large cleared staging area on the drill side is needed for the drilling equipment, support equipment, and a sump for drilling muds. The cleared area on the other side of the river is needed for a sump and to fabricate and test the section of pipe that would be pulled under the river. Sump areas are required to contain the drilling fluids. Thus, decisions to avoid instream trenching options result in riparian clearing options.

Total construction time for crossing a particular stream or river could take a total of 4 to 5 weeks, from site clearing/preparation to restoration, but the actual time required to place the pipeline in a stream crossing could take 48 hours or less. Due to flows, weather, and allowable construction windows across rivers, some crossing construction would be independent from, and at some distance from, activity along the construction spreads.

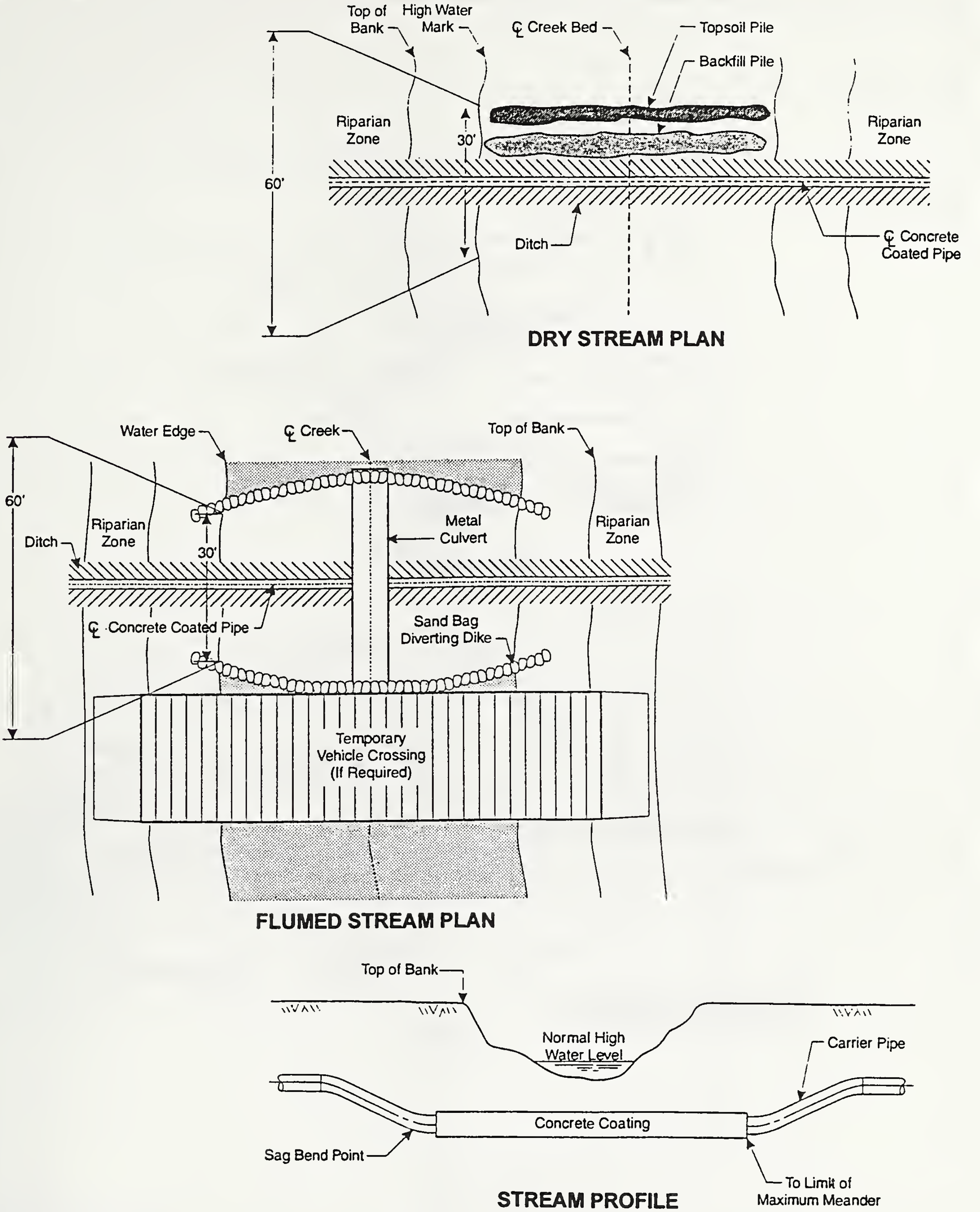
Twelve river crossings would use existing bridges, attaching the pipeline to these structures (Figure 2-10). Very little riparian habitat would be removed, and no in-channel work would occur at these bridge crossings.

Table 2-5. Summary of Major Rivers and Unique Crossing Construction Methods, Proposed Pipeline Project

Stream Name	Crossing Geometry: Bank to Bank Width	Bank Height	Depth	Crossing Method
Snoqualmie River Crossing #1	200'	15'	6 to 8'	Preferred: Bridge Alternative: Horizontal directional drill
Peoples Creek				
Crossing #1	10'	15'	1'	Over culvert
Crossing #2	10'	10'	1'	Open cut w/flume
Griffin Creek	10'	1 - 2'	1'	Open cut w/diversion
Tolt River	40' main channel 30' secondary channel	6' (riprap along north bank)	1 to 2'	Open cut w/diversion
Tokul Creek	30'	20'	2 to 3'	Bridge
Snoqualmie River Crossing #2	120'	10 to 20'	8 to 10'	Bridge crossing
South Fork Snoqualmie River Crossing 1	500' main channel	15 to 20'	4 to 5'	Bridge crossing
South Fork Snoqualmie River Crossing 2	120' 300' secondary channel	60'	3 to 4'	Bridge crossing
West Slope of Snoqualmie Pass - several creeks: Boxley Creek - w/flume or diversion Change Creek - bridge Hall Creek - wet trench Mine Creek - wet trench Rock Creek - w/diversion[1] Harris Creek - w/diversion[1] Carter Creek - w/flume or diversion Hansen Creek - w/flume or diversion[1]	10 to 50'	2 to 12'	dry to 2' with large boulders	
Humpback Creek[1]	25'	3'	2 to 3', fast flowing with large boulders	Wet trench
Roaring Creek[1]	60 to 80'	20'	20 to 30'	Open cut w/diversion
Meadow Creek[1]	120'	15'	2 to 3'	Open cut w/diversion
Cabin Creek	20'	1 to 2'	1 to 2' adjacent to wetland	Open cut w/diversion
Yakima River	200'	4'	3 to 6'	Open cut w/diversion
Columbia River alternative locations:				
Preferred: Below Wanapum Dam[2]	2,100'	40 to 45'	15 to 25'	Preferred: Horizontal directional drill
Four Alternatives 1. I-90 Bridge[2] 2. Beverly Railroad Bridge[2] 3. Upstream of I-90 Bridge[2] 4. Wanapum Dam[3]	4,350'	shallow bank	105'	Four Alternatives: 1. Cross on I-90 Bridge 2. Cross on Beverly Railroad Bridge 3. Wet trench upstream of I-90 Bridge 4. Cross on Wanapum Dam

Administered federal lands:
[1]U.S. Forest Service
[2]U.S. Bureau of Reclamation
[3]Grand County P.U.D.

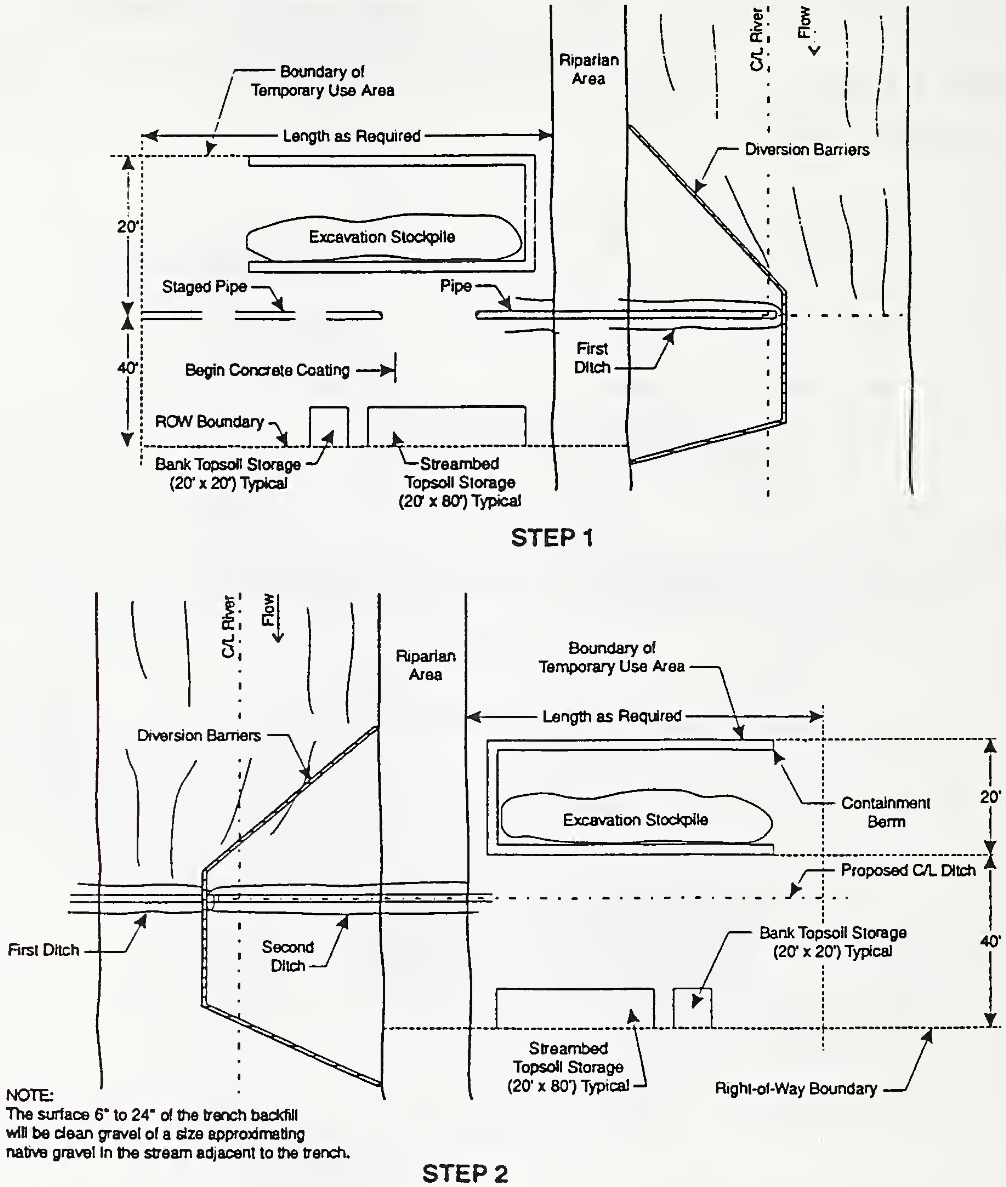
Source: OPL 1998.



Source: OPL 1998.

TYPICAL DRY OR FLUMED STREAM AND EQUIPMENT CROSSING

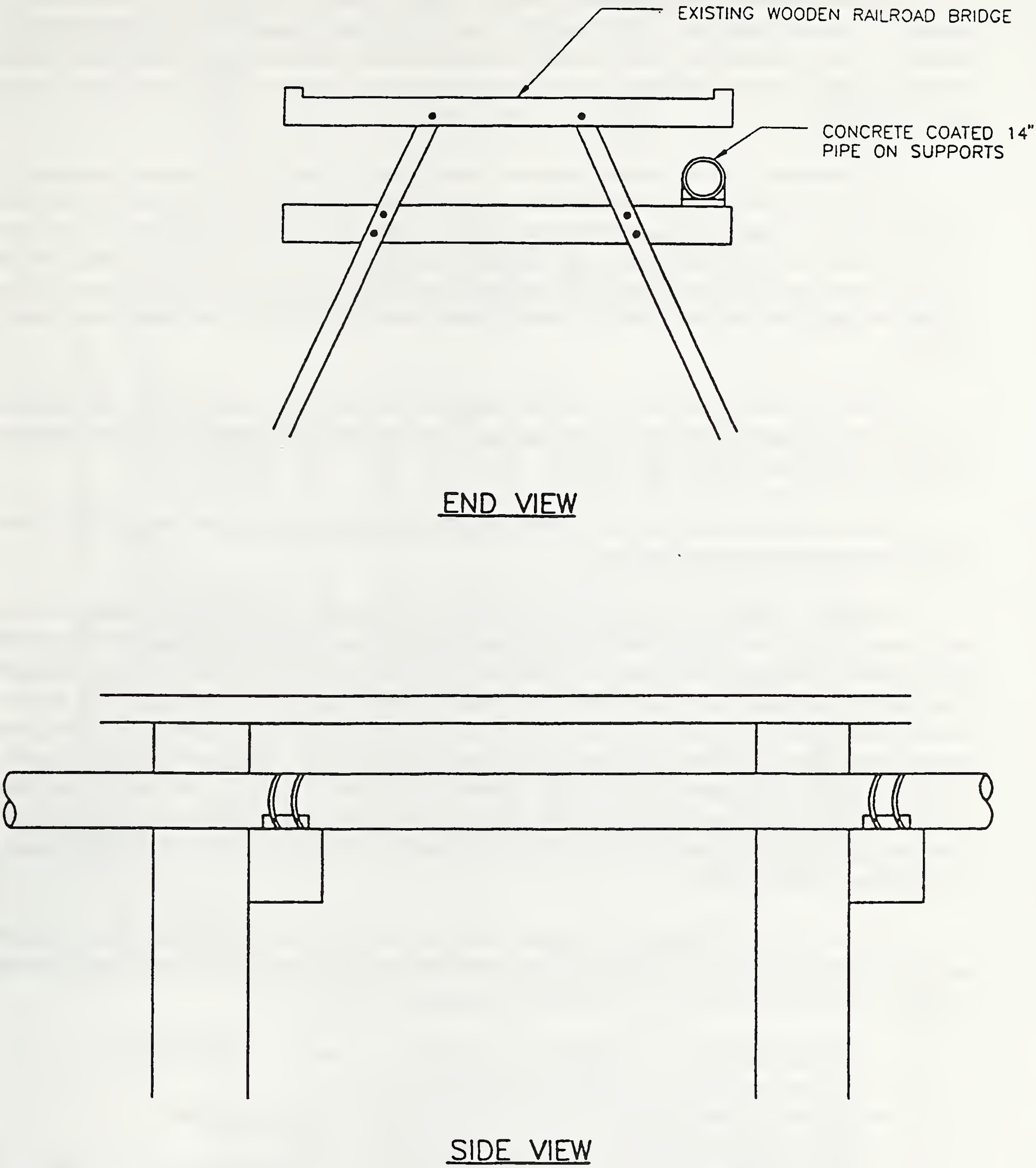
Cross Cascade Pipeline
Washington
FIGURE 2-8



Source: OPL 1998.

TYPICAL DIVERTED STREAM CROSSING

Cross Cascade Pipeline
Washington
FIGURE 2-9



Source: OPL 1998.

WOODEN BRIDGE CROSSING DETAIL

Cross Cascade Pipeline
Washington
FIGURE 2-10

Other Pipeline Crossings. Unlined irrigation canals with low flow rates would be crossed by open cut methods. If flow rates are high, the crossing would be done using boring and jacking. Concrete irrigation canals would be crossed under the canal using boring and jacking techniques, where feasible. Unfavorable subsurface conditions at concrete canal crossings may require spanning a canal.

The boring and jacking method requires a starting and ending pit. The pits are excavated to a desired depth that would allow horizontal movement of the pipe under the water body. The areas for the starting and ending pits would be cleared of all vegetation and would be about 3.0 by 3.0 m (10 by 10 feet) for the bottom of the receiving pit and about 6.1 by 15.2 m (20 by 50 feet) for the bore pit. Canals would be bored using conventional auger boring or guided boring techniques unless subsurface conditions are unfavorable (i.e., rock, gravel, glacial till, or high water tables with flowing sands).

Railroad crossings would be installed using the jack and bore method only. The pipeline would be bored under federal and state roadways, such as I-90. The pipeline would be trenched through county, local, and private roads.

Other crossing techniques may include flexible couplings, greater buried depth (below slide depth), and culvert crossing upgrades.

Pipeline Testing. The pipeline at each water crossing would be hydrostatically tested at least twice. The pipe would be constructed, tested, placed in the trench, backfilled, and then tested again. Many crossings would again be tested as part of the testing of 10 longer pipeline segments once they are completed. The hydrostatic test would be done by sealing the end of the pipe section, filling it with water, applying 125 percent of the maximum operational pressures, and holding that pressure for 4 hours, or 8 hours if the pipeline has already been buried. Water at that pressure would be likely to show leaks immediately. A drop in pressure over the 4- to 8-hour test would also show a leak. Any leaks in the pipeline would be repaired by pipe or valve replacement until subsequent tests confirmed the absence of leaks. The test water would then be pumped out and, where possible, reused in subsequent segment tests.

A total of 1.5 million gallons of water would be needed to test the pipeline, plus 4.2 million gallons to test the tanks at the Kittitas Terminal. Water needed to conduct the hydrostatic testing would be obtained, if possible, from the following sources (Table 2-6):

- Snoqualmie River - 1.23 million gallons (3.76 acre-feet)
- City of North Bend - 32,583 gallons (0.10 acre-feet)
- Cascade Irrigation Canal - 166,173 gallons (0.51 acre-feet) (pipeline)
- Waluke Branch Canal - 237,855 gallons (0.73 acre-feet)
- Cascade Irrigation Canals 4.2 million gallons (12.9 acre-feet) (Kittitas Terminal)

Potential secondary sources of water, in the event that the above sources are not fully available, include the Alderwood Water District, Woodinville Water District, City of Carnation, City of Ellensburg, Port of Royal Slope, and the City of Othello.

Table 2-6. Hydrostatic Testing Cross-Country Segments

Segment Number	Description	Mile Post Start - End	Segment Length (miles)	Water Source	Total Quantity Needed for Segment Testing	Quantity Added to Previous Segment Test Water	Amount Available for Testing of Next Segment	Discharge Location	Discharge Quantity
1	Thrasher to Snoqualmie River	0 - 8.3	8.3	Snoqualmie River	1.08 a-f (351,895 g)	1.08 a-f (351,895 g)	1.08 a-f (351,895 g)	None	0.00 a-f
2	Snoqualmie River to North Bend Pump Station	8.3 - 37.3	29.0	Snoqualmie River (2.68) plus water used for Segment 1	3.76 a-f (1.23 million g)	2.68 a-f (847,155 g)	3.76 a-f (1.23 million g)	None	0.00 a-f
3	North Bend Pump Station to Stampede Pump Station	37.3 - 67.1	29.8	City of North Bend (0.10) plus water used for Segment 2	3.86 a-f (1.26 million g)	0.10 a-f (32,583 g)	3.86 a-f (1.26 million g)	None	0.00 a-f
4	Stampede Pump Station to Monahans Road	67.1 - 73.9	6.8	Supplied from Segment 3 Test Water	0.88 a-f (286,729 g)	0.00 a-f	3.65 a-f (1.19 million g)	Stampede Station	0.21 a-f
5	Monahans Road to Thorpe Prairie Road	73.9 - 95.3	21.4	Supplied from Segment 3 Test Water	2.77 a-f (902.546 g)	0.00 a-f	3.65 a-f (1.19 million g)	None	0.00 a-f
6	Thorpe Prairie Road to Kittitas Terminal	95.3 - 123.4	28.1	Supplied from Segment 4 and 5 Test Water	3.64 a-f (1.19 million g)	0.00 a-f	3.65 a-f (1.19 million g)	None	0.00 a-f
7	Kittitas Terminal to Ginkgo State Park	123.4 - 141.8	18.4	Supplied from Segment 6 Test Water	1.98 a-f (645,141 g)	0.00 a-f	3.26 a-f (1.06 million g)	Kittitas Terminal	0.39 a-f
8	Ginkgo State Park to Beverly-Burke Pump Station	153.7 - 188.8	11.9	Supplied from Segment 6 Test Water	1.28 a-f (417,061 g)	0.00 a-f	3.26 a-f (1.06 million g)	None	0.00 a-f
9	Beverly-Burke Pump Station to Othello Pump Station	153.7 - 188.8	35.1	Supplied from Segment 7 and 8 Test Water plus water (0.51) from the Cascade Irrigation Canal	3.77 a-f (1.23 million g)	0.51 a-f	3.77 a-f (1.23 million g)	None	0.00 a-f
10	Othello Pump Station to Pasco Delivery Facility	188.8 - 230.7	41.9	Supplied from Segment 9 plus water (0.73) from the Wahluke Branch Canal	4.50 a-f (1.47 million g)	0.73 a-f	0.00 a-f	Indirectly to Snake River from Pasco Delivery Facility	4.50 a-f

Source: OPL 1998. Note: g = gallons, a-f = acre-feet.

After testing is complete, the test water would be analyzed for parameters such as pH, oil and grease, or other tests as required by permitting agencies and filtered before being discharged into a water body. Hydrostatic test water would be discharged into three locations: into the ground at the Stampede Pump Station (0.21 acre-feet), into the ground onsite or to the stormwater pond at the Kittitas Terminal or into the Cascade Irrigation Canal near the terminal (0.39 acre-feet) and indirectly (through filtration) into the Snake River at the Pasco Terminal (4.5 acre-feet).

X-ray welding is another form of testing. OPL will require all welding be X-ray tested to check for weld quality and potential flaws.

2.3.3.2 Pump Stations and Block Valves

Once the pump units are installed, the pipe connections, valves, and metering equipment would be installed. About 20 workers would construct each of the three initial pump stations (Thrasher, North Bend, and Kittitas) concurrently with the construction of the pipeline. Construction of the three pump stations would require about 8 months. Construction of the Kittitas Pump Station would occur concurrently with construction of the Kittitas Terminal. The three remaining pump stations (Stampede, Beverly-Burke, and Othello) may be built in the future if demand for pipeline capacity increases to the point of maximum pumping capacity. These pump stations could be built independently of each other.

Construction of the metering station outside of the gate of the Northwest Terminalling Facility in Pasco would require an additional 8 to 10 workers. Construction of this station would also occur in conjunction with pipeline construction and would take about 30 days.

2.3.3.3 Kittitas Terminal

The entire terminal site would first be cleared and graded during the first and second months of the construction schedule. Construction on the site would include fencing the area and then excavation and pouring of foundations to support the equipment and containment berms. About 15 people, in two workcrews, would work on tank fabrication. Tank fabrication would be completed in 6 months. Tank integrity would be tested using the hydrostatic test method (discussed below).

Construction of other terminal facilities (e.g., piping, buildings, and mechanical and electronic components) would begin 1 month later than the tanks and also last for 6 months. Most of the equipment (e.g., scraper traps, station boosters, and mainline pumps) would be manufactured offsite and trucked to the terminal for installation. The peak construction workforce for these other terminal facilities would be an additional 30 people.

The Kittitas Terminal is located within the Cascade Canal District. The District is privately owned by property owners in and near Kittitas. As an owner of property (the terminal site) near Kittitas, OPL would also have rights to use water from the canal, which could be used as a source of water for hydrostatic testing of the tanks. Approximately 4.2 million gallons of water would be

needed. It could be obtained from the canal at a rate of 5,000 gallons per minute (gpm), which would require 14 hours to fill the tanks.

Preliminary discussions with the Canal District have indicated that obtaining water at a rate of 5,000 gpm during either the spring or fall would not impact downstream users. To access the water, a temporary line would be installed between the site and the nearest point on the canal, a distance of approximately 0.61 km (0.38 mile).

The water would be retained onsite until all tanks are completed and tested, which would take approximately 60 to 90 days. The water would be tested in the tank. If water quality tests showed that the water was within acceptable parameters, it might be discharged at a controlled rate back to the irrigation canal. As an alternative, the water could be pumped, after filtering, into the onsite retention pond at a controlled rate and allowed to evaporate. The retention pond would be approximately 1-1/2 acre-feet deep and would be adequately sized to hold the test water in addition to sizing requirements related to tank capacity, rainfall capacity, and excess capacity, as required.

2.3.4 Operation

This section describes operation of the pipeline and associated facilities, including maintenance, inspection, and spill response.

2.3.4.1 Renton Facility, Kittitas Terminal, and Pasco Delivery Facility

Pump stations would be controlled remotely from the OPL Renton facility and also controlled locally. The four OPL employees assigned to the OPL Renton facility would be responsible for local control and monitoring of product movements through the pipeline system. Four workers would be employed at the Kittitas Terminal during operation of the pipeline to handle incoming tanker truck loading activities. Two employees would be assigned to the Pasco Delivery Facility.

2.3.4.2 Pipeline Maintenance

An additional 6 to 10 OPL employees would be responsible for maintenance of the pipeline and the ROW. The width of the corridor to be maintained (i.e., the permanent easement) for the pipeline is 9.1 m (30 feet). The 30 feet would allow vehicles to access the area directly above the pipeline in the case of an emergency or for special inspection activities, and would enable small-scale excavation of the pipeline where necessary for visual inspection and/or repair. Areas such as wetlands and farmland would not need maintenance clearing. Routine maintenance along the ROW would include visual inspection, periodic clearing of vegetation, repairs to ROW markers, and inspection and maintenance of the cathodic protection system.

Details of vegetation maintenance would be established with state and federal agencies. In general, herbicide use would be minimized in favor of mechanical clearing. Trees would be kept

down, but other vegetation could be maintained. A 5-year monitoring plan for revegetation, including contingency plans, would be developed and implemented. Parameters to be monitored would include the success of replanted vegetation, invasive species, and damage to remaining vegetation along the corridor, such as blowdown or erosion of topsoil. Additional erosion/sediment control and revegetation would be provided as necessary.

Visual inspection of the pipeline would include ground patrols and fixed-wing aircraft inspections (at an average height of 304.8 m or 1,000 feet above ground level) about once every 2 weeks, depending on weather conditions, to ensure that there was no unauthorized encroachment onto the ROW. During these patrols and aerial inspections, ground slope and river channel profiles would be monitored for stability. Such visits could detect a leak from odor or dead vegetation if the leak was below SCADA detection limits. A circular, computerized sensing device ("smart pig") would also be used infrequently (at 5-year intervals unless some event indicated the need to do so more frequently) to internally scan and detect corrosion, dents, or other defects in the pipeline wall so that repairs could be made before a leak occurred. Monitoring specifics would be developed in permit documents.

No new access roads would be constructed or maintained for the project. Existing open roads would continue to remain open during project operation and would be maintained by the existing responsible agency (unless otherwise agreed to with an agency). Previously closed roads used during construction would again be closed during operation. Roads that are open in the summer but are not plowed in the winter and are closed, would continue to be allowed to close in the winter. In areas where continued winter access is required by OPL, such as using Forest Service Road 54 to access the Stampede Pass Pump Station, snowmobiles would be used to access the site. Such access to the pump station could occur as much as once per day, but is more likely to occur once or twice a week.

OPL would also contract with individuals or hire employees who live along the pipeline to respond to a spill within 1 hour of notification in accordance with state policy. It is OPL's policy to maintain a 60-minute response time. It is not known where these employees would be located or exactly how many contract employees would be hired.

2.3.4.3 Pump Stations and Block Valves

Pump stations and block valves would be electric. They would be controlled remotely from the OPL Renton facility but could also be controlled manually onsite. The control buildings for block valves would house electronic equipment used to remotely monitor the various instruments at the site and control the position in the block valve. They would also house an uninterruptible power supply, which would energize the electronics in the event of a commercial power outage, and a telecommunications interface to the pipeline system's SCADA network.

Power would be brought to the sites from adjacent electric utility service distribution lines. In the event that commercial power was not readily available, a stored-energy actuator would be used on the block valve in lieu of a motor-operator, and power for the electronics would be developed onsite using a suitable alternative energy source such as solar panels. The stored-energy actuators would be designed to use nitrogen pressure to close the valve and a spring to open the valve.

Sufficient nitrogen would be provided to support multiple operations of the valve and to be replenished before the pressure dropped below the minimum operating point. The nitrogen pressure would be remotely monitored to support this maintenance function.

The maximum achievable flow rates for the pipeline during operation are provided in Table 2-7. The operating capacity is anticipated to be 80 percent of the mean achievable flow rate for the Thrasher Station to Kittitas segment (MP 0.0 to 124.0) and 91 percent for the Kittitas to Pasco segment (MP 124.0 to 231.0). Operating capacity is the amount of product all types that can be pushed through the line in various batches and mixed product compared to the design capacity of the line. A single product flowing 100 percent of the time would probably have an operating capacity of 100 percent but this will not occur with the OPL line.

Table 2-7. Achievable Flow Rates (barrels per hour)

Segment	Diesel	Gasoline	Mean
Thrasher to Kittitas	5,227	6,785	6,064
Kittitas to Pasco	4,635	6,100	5,417
Source: OPL 1998.			

2.3.5 Construction and Operational Costs

The costs of constructing the proposed pipeline, pump stations, Kittitas Terminal, and the Pasco Delivery Facility are estimated by OPL at $105.1 million (Table 2-8). Of this total, $84.9 million would be spent constructing the pipeline portion of the project and $12.6 million would be spent on the pump stations, Kittitas Terminal, and the Pasco Delivery Facility. About $5.6 million of this total would be spent on local non-labor procurements (i.e., construction materials and services) and $7.6 million in local sales and use taxes.

Table 2-8. Pipeline Project Costs, by County

County	Component	Cost ($)	Pipeline Mileage
Snohomish	Pipeline (14")	5,130,002	14.0
	Pump Station	869,840	
	Subtotal	5,999,842	
King	Pipeline (14")	15,939,650	43.5
	Pump Station	852,121	
	Subtotal	16,791,771	
Kittitas	Pipeline (14" & 12")	33,894,658	92.5
	Terminal	10,304,895	
	Subtotal	44,199,553	
Grant	Pipeline (12")	11,364,537	30.5
Adams	Pipeline (12")	3,502,513	9.4
Franklin	Pipeline (12")	15,060,221	41.1
	Delivery facility	603,959	
	Subtotal	15,644,180	
Total Pipeline Sections		84,891,581	231.0
Total Other Facilities		12,630,815	
Sales Tax		7,596,951	
Grand Total		105,119,347	

Source: Based on Application for Site Certification (OPL 1998).

Transport of petroleum products to eastern Washington by the proposed pipeline during operation is estimated to cost shippers $1.50 per barrel (Table 2-9) although actual tariffs will be approved by utility regulators. An estimated $310,000 would be paid in property taxes each year by OPL.

Table 2-9. Estimated Costs of Transporting Petroleum Products under the No Action and Proposed Project Alternatives

Alternative	No Action - Pipe plus River Barge	No Action - Sea-going Barge plus River Barge	Rail Transport	Proposed Pipeline
Pipe Transport	$0.40/barrel	N.A.	N.A	$1.25/barrel
Sea-Barge Transport	N.A.	$1.25/barrel	N.A.	N.A.
River Barge Transport	$1.15/barrel	$1.15/barrel	N.A.	N.A.
Rail Transport	N.A.	N.A.	$2.95/barrel	N.A.
Handling ($0.25 at each transfer)	$0.50 (2 transfers)	$0.50 (2 transfers)	$0.50 (2 transfers)	$0.25 (1 transfer)*
Total Cost Per Barrel	$2.05	$2.90	$3.45	$1.50

N.A. = Not applicable.
* OPL has provided costs of $0.25 and $0.27 for terminal charges at Pasco.
Source: Analysis of Alternatives (OPL 1998).

2.3.6 Mitigation Associated with the Proposed Action

OPL has already incorporated a number of measures into the project design during siting of the pipeline and design of other project facilities, as described in Appendix C. These measures have included micrositing the pipeline (i.e., minor movement in its location to avoid or minimize local impacts, see Appendix E), implementing best management practices, and other measures. A number of the route improvements within the proposed corridor were made based upon the findings from additional field studies and after consultation with federal, state, and local agencies and property owners. This micrositing will continue and, where proposed, future mitigation plans will provide additional measures. The measures described in Appendix C are considered part of the proposed action. Additional mitigation is suggested, if deemed necessary, within Chapter 3 of this EIS.

2.4 NO ACTION

2.4.1 Ability of the No Action Alternative to Meet the Purpose and Need

Under No Action, the proposed Cross Cascade pipeline would not be constructed. Shippers would continue to receive refined product from northwest refineries under the current system of pipeline and/or trucking and barging. Shippers in eastern Washington would pay more per barrel than they would with the proposal (see Table 2-9). In addition, all OPL shippers would continue to be prorated due to the lack of capacity of the existing pipeline system. To receive needed product,

shippers would meet their transportation needs with more tanker trucks, ships, Puget Sound barges, and barges along the coast and up the Columbia River. This would be a more expensive and less efficient transportation system than the proposed pipeline. Shippers would receive their product except during transport closures but would not receive all product ordered via pipeline because the existing line is oversubscribed.

The No Action Alternative is described in the next section, and criteria used to evaluate petroleum transportation alternatives and components are discussed in more detail at "Alternatives Considered but Eliminated from Detailed Study" later in this chapter. Some of the criteria are discussed here as they apply to the No Action Alternative's ability to meet the Purpose and Need defined in Chapter 1.

Cost Effectiveness. Shippers are requesting a system that costs less than current truck and barge systems. Because this project is proposed to reduce existing shipping costs, alternatives which cost less than existing are cost-effective to various degrees and those costing more are not. As shown in Table 2-9, it would cost an estimated $0.55 more per barrel to transport product to Pasco under No Action than with the proposed pipeline. Neither No Action nor the proposal has any significant effect on per gallon fuel prices to the public, although annual cost differences can be substantial. From the shippers' standpoint, No Action is less cost-effective than the proposal because the existing cost of transporting would be reduced by the project at no cost to the shipper. It cannot be said that No Action is not cost-effective at all because it is occurring today (i.e., shippers are transporting petroleum products via other modes). Shipping methods such as pipelines are generally more cost-effective and they become even more so over time because they are more efficient than other modes of transport.

Efficiency. No Action is a less efficient and less direct delivery system because it represents a system of pipeline overcapacity supplemented by multiple modes of transport and more transfers than a point-to-point pipeline. There are minor problems with No Action such as oversubscription with delays and multiple transfers, and the reliability of delivery would continue to degrade slightly with more and more trucks and barges. Such problems include weather, slide, and avalanche closures of I-90 which stop trucks dozens of times per year, and lock maintenance and high river flow closures that occasionally stop barges. Because tanker trucks and barges have been and can continue to be less reliable on occasion, they are not as efficient as a system such as a pipeline which is not subject to weather events. Trucking and barging are also less energy efficient transport modes than pipelines.

Environmental Soundness. Any alternative shown to be environmentally sound should show an improvement or at least a status quo in environmental compliance and risk over time. No Action itself can be considered environmentally sound today since there are no major problems with the current system. However, due to continuously increasing frequencies of barge, truck, and ship activity involving more transfers, No Action becomes less environmentally sound over time. No Action would require more transfers from one mode of transport to another (i.e., to trucks and barges), when accidents are more likely to occur. The oil spill risk analysis in this EIS demonstrates that No Action would have a greater frequency of spillage than the proposed pipeline and a greater risk of injury and fatalities to the public. Therefore, based on accidents, death, and spill frequency, No Action would not meet the need for an environmentally sound alternative as well as the proposed pipeline. The major factor is increased truck accident potential which dominates the spill risk analysis

in terms of frequency and human health risk. The proposal would also degrade in risk over time but to a lesser degree (see Section 3.18, Health and Safety).

The pipeline puts new resources at risk which are not now at risk. This includes rivers, the Cascades, agricultural lands, aquifers and wetlands. Without the pipeline, Puget Sound and the Columbia and Snake Rivers are continually exposed to risks from barge transport. Aside from quantified spill risk frequencies and volumes for all alternatives, this fact is difficult to quantify, and this EIS does not attempt to evaluate the value of the resources at risk. It is difficult to conclude that a quantifiable reduction in risk to existing resources (from barging and trucking) compared to a lower but new risk to new resources (from the pipeline) is more or less environmentally sound.

Meeting Long-Range Transportation Needs. The multiple mode delivery issues with No Action are made worse by growth in demand from shippers resulting in more and more trucks, barges, tankers, Puget Sound barges, and trucks at refineries. The longer the range that one evaluates, the less effective No Action is in meeting long-range transportation needs of shippers. Both No Action and the proposal would meet long-range transportation needs, although the proposal would do so more efficiently and reliably. This efficiency would be the result of fewer transfers from one mode of operation to another. The proposed pipeline would avoid the need to make a least two transfers of product from the existing pipeline to tanker trucks and then to tanks. The proposed pipeline would also be more energy efficient in moving product. A study conducted by the RAND Corporation determined that, on average, water carriers consume about 500 BTUs of energy per ton-mile, rail consumes 750 BTUs per ton-mile, and trucks consume 2,400 BTUs per ton-mile (USDOT 1994). Looked at in another way, "inland water transport requires 3.15 gallons of fuel per 1,000 ton-miles of freight, rail freight requires 4.21 gallons (33 percent more than barges), and truck freight requires 8.33 gallons (164 percent more than barges).

Summary. Thus, the No Action Alternative is less cost-effective than the proposal, somewhat less environmentally sound, is not as efficient as the proposal, and will only meet long-range needs by expanding truck activities across Snoqualmie and Stevens Passes, and barge operation along the coast, in Puget Sound, and in the Columbia River. No Action is evaluated relative to the proposed pipeline to meet NEPA and SEPA compliance requirements.

2.4.2 Description of No Action

The No Action Alternative would keep the petroleum product delivery system at a status quo, which means that the existing pipeline system would remain and more barges and more trucks would be needed to handle future demand from the northwest refineries. Shippers desiring to use the OPL pipeline would continue to be prorated and would have to seek other means to transport product. This situation has been occurring and continues to occur at this time. Tidewater Barge Lines, Inc., an opponent of the project, agrees with this prediction and has been ordering and building larger barges to plan for this growth. An oil industry expert hired by Tidewater has confirmed that, in his opinion, growth in demand for transport will range from 1 to 2 percent per year (Johnson and Dickins pers. comm.). The existing barging and trucking activities that would be eliminated by the proposal would, instead, continue operation under No Action. This includes terminal operations in Clarkston

and Umatilla, Tidewater operations up the Columbia and Snake Rivers, and barge operations on Puget Sound in the Strait of Juan de Fuca and along the coast.

Because the existing pipeline system would remain with or without the project, it is a "constant" and the difference between No Action and the proposal can be described in terms of a new line and terminal versus barging/trucking. For this reason, impacts of the existing line itself are not discussed in detail in this EIS with or without the project. They are the same in either case.

Under the No Action Alternative, current modes of product transport would continue and would increase in volume. These modes -- pipeline, trucking, shipping and barge activities in Puget Sound, barging up the Columbia River, and other pipelines serving Washington -- are discussed below.

2.4.2.1 Seattle/Portland (Existing) Pipeline

Without the proposed pipeline, OPL would continue to operate its existing pipeline system at its current at-capacity levels, and at rates that provide economic returns under tariffs approved by the Federal Energy Regulatory Commission (FERC) and the Washington Utilities and Transportation Commission (WUTC). Refined petroleum products from the refineries in northwestern Washington that are destined for central and eastern Washington would continue to be transported through the existing line and via other means.

The existing pipeline begins as a 40.6 cm (16-inch) diameter line from refineries in Whatcom County and is joined by another pipeline of the same diameter that extends easterly from refineries near Anacortes in Skagit County. These two pipelines join at the Allen Station west of Burlington, and from this point a 40.6 cm (16-inch) and a 50.8 cm (20-inch) pipeline parallel each other to the Renton Station. At Renton, these pipelines are connected to a 30.5 cm (12-inch) pipeline that serves the Sea-Tac International Airport, a 30.5 cm (12-inch) line that serves the petroleum product terminals on Harbor Island in Seattle, and a 35.6 cm (14-inch) line that extends to Vancouver/Portland. This pipeline serves western Washington/Oregon markets including Sea-Tac International Airport, as well as providing the first leg in the current system for transporting petroleum products to central and eastern Washington.

Because of the lack of capacity of the existing OPL pipeline system and laws regarding common carriers, OPL has had to place restrictions on its existing pipeline system by prorating capacity among shippers. The ability to serve the airlines at Sea-Tac and Portland International Airports has been affected. The existing OPL pipeline is the only means for transporting jet fuel to the Sea-Tac International Airport. Air travel is anticipated to continue to increase (as evidenced by the need for a third runway at Sea-Tac International Airport). Proration increases costs for airlines in all cities because product must be acquired via more expensive means.

The product would continue to be transported to central and eastern Washington from northwestern Washington refineries by one of the following methods:

(1) From OPL's existing pipeline to the south Puget Sound area and from the northwest refineries directly, where products are transferred to tanker trucks for transport to central and eastern Washington using highways (I-90 and U.S. Highway 2, respectively) across the Cascade Mountains.

(2) OPL's existing pipeline to Vancouver/Portland, where products are transferred onto river barges for transport up the Columbia and Snake Rivers to Pasco, Umatilla, and Clarkston.

(3) Ocean-going barge or tanker ship from north Puget Sound, to Harbor Island, or through the Strait of Juan de Fuca, south along the Pacific Ocean coast of Washington to the Columbia River, then east up the Columbia River to Vancouver/Portland, where products are transferred onto river barges for transport up the Columbia River (this occurs during prorationing periods).

(4) Occasional transport of product from California to Portland where it is transferred to Tidewater barges serving markets up the Columbia River.

2.4.2.2 Increased Trucking to Western, Central, and Eastern Washington Customers

Under the No Action Alternative, increased trucking of product would continue in order to respond to the increased demands for petroleum products in western, central, and eastern Washington. OPL anticipates that trucking across the Cascades (via Stevens Pass and Snoqualmie Pass) would increase from 65 tanker trucks per day, to 71 trucks in 1999, 80 trucks in 2004, 90 trucks in 2009, 101 trucks in 2014, and an average of 112 trucks per day in 2019 (Table 2-10). This rate of increase would be expected to continue into the future. This growth can be roughly calculated showing a 1.5 percent annual increase to 50,000 bbls heading east. This increase is approximately at 31,500 gallons per day each year and would require four to five trucks if all was carried by truck. OPL estimates that less than half of this per day growth would travel via truck (two trucks per day), and the balance would travel by barge. Conversations with the four Puget Sound refinery managers have confirmed that trucking activity at the refineries also increases during proration periods. A Texaco marketing manager stated that they haul product from Harbor Island to Tumwater by truck as well (Stanley pers. comm.).

Compared to the 30-year planning period of the proposed pipeline, at this projected rate, truck traffic would rise from an average of 65 trucks per day in 1996 to an average of 128 trucks per day in 2026. As trucks (and barges) carried a proportionately greater and greater share of the product, transportation cost of that product would rise. The average number of trucks per day across the Cascades through Stevens and Snoqualmie Passes would eventually increase to the point that another mode of transport may be proposed again.

Table 2-10. Central and Eastern Washington Product Transport Demand 1996 - 2019 (average barrels per day)

Forecasted Demand	1996	1999	2004	2009	2014	2019
Truck	13,800	13,590	15,324	17,191	19,203	21,370
Barge	38,405	39,915	45,006	50,491	56,399	62,764
Subtotal	52,205	53,505	60,330	67,682	75,602	84,134
Yellowstone Pipeline	22,905	28,500	28,500	28,500	28,500	28,500
Chevron Pipeline	6,401	6,300	6,300	6,300	6,300	6,300
Subtotal	29,306	34,800	34,800	34,800	34,800	34,800
Total	81,511	88,305	95,130	102,482	110,402	118,935

Conversions:
1 barrel = 42 gallons
1 tanker truck = 8,000 gallons or 190.5 barrels per load
1 large bulk barge = 2,730,000 gallons or 65,000 barrels per load

Source: Based on information provided by Dames & Moore for OPL's Application for Site Certification.

2.4.2.3 Increased Barging up the Columbia River

Before 1997, a combination of three large and small barges transported petroleum products from Vancouver/Portland to Pasco via Tidewater Barge Lines, Inc.. These barges were partially loaded, so there was capacity to increase the volume of product transported without increasing the number of trips. However, a fourth barge had been planned to be added in 1997.

Under the No Action Alternative, the total barge traffic up the Columbia River alone is projected to increase from 292 trips annually (24 trips per month) in 1999, to 346 trips (29 per month) in 2014, and 423 barge trips annually (35 per month) and an average of 62,764 bbls per day in 2019. A large liquid bulk barge transports up to 65,000 bbls of product per trip and a small barge transports about 30,000 bbls of product per trip. As large barges are added to the fleet, the number of trips may be reduced. This would increase the efficiency of barge shipments but remain less efficient than a pipeline. Fewer, larger barges would reduce the frequency of collision and increase the maximum potential spill volume.

2.4.2.4 Increased Barging Elsewhere

Refinery managers have stated that some of their barge and tanker activity from the northwest refineries which is occasioned by insufficient capacity of the OPL line also enters the Columbia River to Portland (Stanley pers. comm.). Without the project, the four northwest refineries would continue to haul product by barge and tanker from the refineries to Harbor Island and to Portland. Such hauling would all but stop with the project. Texaco, for example, had 58 shipments in 1996: 31 shipments from Marche Point totaling 988,848 bbls to Portland and 27 shipments from Marche Point

totaling 535,499 bbls to Harbor Island (Stanley pers. comm.). This is 4.8 shipments per month averaging 28,300 bbls per shipment on Puget Sound and along the coast. Texaco, then, ships three barges per month up the Columbia to Portland in addition to the Tidewater Barge Lines, Inc. shipments. Another refinery reported barge shipments of 120,000 bbls to 240,000 bbls per month as a result of proration. Based on an average of 50,000 bbls per barge, this would be 2.5 to 5 barges per month. Other refineries ship during existing proration events as well, perhaps totaling 12 to 20 barge shipments per month on Puget Sound.

One barge haul issue, the Chevron product from California, is uncertain. In a letter dated October 10, 1997, Tidewater Barge Lines, Inc. stated they would discontinue all petroleum shipment operations if the pipeline were built. Because Tidewater is the only petroleum carrier on the Columbia River, it is probable that the proposal would eliminate all petroleum product barge traffic on the Columbia River above Bonneville Dam, and most, if not all, such traffic below Bonneville Dam. This would eliminate the current barging system which carries Chevron products from California up the Columbia to the Chevron terminal or to Tidewater terminals. It is unknown how the product from the Richmond, California market would continue to reach its eastern Washington destination. Options include rail, truck to Boise, or using the new pipeline via barging from California to Marche Point or Cherry Point. Under No Action, Chevron would continue to ship an average of 3,000 bbls per day to Portland.

Tidewater Barge Lines, Inc.'s storage terminals in Clarkston and Umatilla would continue to operate under No Action, including trucking and transfer of product to and from those locations. Thus, the project would result in one oil terminal (Kittitas) while No Action would maintain two (Umatilla and Clarkston).

2.4.2.5 Increased Ocean Barging from Northwest Refineries

Increased ocean barging of refined petroleum products from the northwest refineries or from California would continue to occur under the No Action Alternative, with subsequent transfer to the river barges in Vancouver/Portland for transport to Pasco or via other means. The ASC estimates that increases in ocean barging would total 5,800 bbls per day in 1999; 12,085 bbls per day in 2004; 19,437 bbls per day in 2009; 27,357 bbls per day in 2014; and 35,889 bbls per day in 2019 (OPL 1998). These increases are in addition to the refined product currently (1995) carried up the Columbia River by Tidewater Barge Lines, Inc. (see discussion of Texaco's ocean barging, above). These increases assume that all the growth in demand in central and eastern Washington is met by deliveries from western Washington.

2.4.2.6 Effect on Product Costs

As shown in Table 2-9, existing transport of petroleum products to central and eastern Washington by pipeline and river barge to Pasco is estimated to cost shippers $2.05 per barrel (5 cents per gallon). Cost for transport by ocean barging and then river barging is estimated to cost $2.90 per barrel (7 cents per gallon). The proposal would deliver to Pasco for an assumed tariff of $1.50 (3.6 cents per gallon) or approximately 3 cents per gallon less than now. Based on initial

throughput, this represents an annual savings to shippers of $12 million per year. The extra costs of transport of No Action may be borne by consumers or, if market prices did not allow that, by the shipping companies and/or their stockholders.

To determine the comparative costs for truck transport to intermediate locations, such as to Kittitas, two trucking companies were contacted. One stated that it cost about $0.033 per gallon to transport petroleum products 100 miles, or about $1.26 per barrel. Another trucking company (Torkelson pers. comm.) said it cost about $1.39 per barrel for that distance. Seattle is about 187 km (116 miles) from Kittitas, so it may cost about $1.46 per barrel to transport petroleum products there, prorating the $1.26 per barrel rate. If transport occurs over Snoqualmie Pass, a fee would also be levied for pipeline transport from the refineries to Harbor Island, where the product would most likely be loaded. It costs about $0.44 per barrel to transport product from the refineries to Portland, and one can assume it would cost about one-third of this for shipment to Harbor Island (located about one-third the distance to Portland), or about $0.15 per barrel. In addition, there would be a $0.25 per barrel transfer/storage fee at Harbor Island if used as a storage site. Thus, the total estimated cost for piping/trucking product from refineries to Kittitas is about $1.46 per barrel without other costs attached, and close to $1.90 per barrel including storage and transportation to Harbor Island.

In contrast, total transport costs to Pasco for the new pipeline were calculated by OPL to be $1.50 per barrel. Transport costs to Kittitas, about half the distance, would be less, perhaps half as much. It is not known whether OPL would charge a transfer fee at Kittitas. Without calculating how much less, and with or without a transfer fee, it can be seen that product delivery to Kittitas via the pipeline (less than $1.50 per barrel) would be less than trucking.

This EIS does not evaluate the petroleum product supply - demand status for Washington, nor does it evaluate retail diesel or gasoline pump costs with or without the project. It is apparent from costs at the pump and confirmed by various refinery managers, that competition drives gasoline prices more than transport costs. In fact, with wholesale gasoline at 70 cents to 80 cents per gallon, and gas selling for less in the Tri-Cities than in Seattle, transportation costs do not appear to determine pump price, while competition does. Gasoline costs less in Richland, further from the refinery, than in Seattle, due to competition. Without the project, shipping costs would escalate as greater shares of product were shipped by barge and truck. The level of competition would remain. With the project, if Tidewater Barge Lines, Inc. ceases operation, and no one else continues it, Chevron's relatively minor role (3,000 bbls per day) in competition may be reduced. No other effects on competition have been identified. No retail price effects have been evaluated for diesel or jet fuel.

2.4.2.7 Effect on Other Pipelines

There have been scoping comments that the project is not needed because other pipelines could provide all the product that central and eastern Washington needs. Another point raised by commentors is that, although shippers clearly prefer OPL to the Yellowstone or Chevron pipelines (based on the 20 percent oversubscription of OPL), conditions will be changing and the other lines will be providing much more product in the future. This prediction is incorrect and is discussed here.

Whether or not the Yellowstone or Chevron pipelines can meet future demands for product transportation in eastern and central Washington without OPL is not directly relevant to the project's Purpose and Need, which is to satisfy shippers' desire to carry northwest refinery products to central and eastern Washington. These other two lines are not alternatives to the proposal. They cannot satisfy that need. Their potential to provide additional petroleum supplies is discussed here because the other pipelines have been mentioned and suggested as alternatives by others and because they would play a role in No Action.

Yellowstone Pipeline. The Yellowstone pipeline is a primary carrier of gasoline, commercial jet fuel, and military jet fuel to eastern Washington in the Spokane and Moses Lake areas from refineries in Billings, Montana. It would continue to serve existing Washington markets with or without the project. This discussion explains how it would operate under No Action.

The Yellowstone pipeline has a capacity of 60,000 bbls per day from Billings to Bozeman, Montana, and 56,000 bbls per day from there to eastern Washington. It transports products to the Conoco, Exxon, and Tosco terminals in Spokane and the Conoco terminal in Moses Lake. It also delivers jet fuel to Fairchild Air Force Base, Spokane International Airport, and Moses Lake Grant County Airport. Because of difficulties in transporting products from Billings to Bozeman, as a result of a recent need to truck product around the Flathead Indian Reservation, deliveries have had to be prorated during the high-use spring and summer months. (EAI 1995.) Some customers, such as Fairchild Air Force Base, received their Billings-based product by truck or rail to their destination. As a result, delivery of transported product to eastern Washington via the Yellowstone pipeline alone only averaged a total of 22,905 bbls per day in 1996 (Table 2-11). Other transportation methods were provided east of Missoula (truck and rail) to satisfy demands and all customers received their product.

The Yellowstone pipeline is 20.3 cm (8 inches) in diameter to Spokane and 15.2 cm (6 inches) to Moses Lake. At Spokane, the Yellowstone pipeline has a connection to the 20.3 cm (8-inch) Chevron pipeline from Pasco. Because the Yellowstone pipeline enters Washington from the east, it would not provide a means of transporting petroleum products from western Washington refineries to central and eastern Washington as requested by shippers. It is at some reliability and cost-effectiveness risk because it no longer serves Washington directly and is applying for permits for reroute and for continued operation. If it receives all permits and approval to keep operating, it will be able to maintain historical levels.

Table 2-11. Volume of Product Transported into Central and Eastern Washington by Pipeline, Truck, and Barge (Average Barrels per Day), 1987-1996

Year	Yellowstone Pipeline	Chevron Pipeline	Trucked	Barged	Total
1987	24,534	13,468	11,587	25,434	75,023
1988	26,895	16,458	11,587	18,891	73,831
1989	24,600	15,742	8,950	23,255	72,547
1990	29,183	13,361	9,213	23,199	74,956
1991	29,583	14,899	9,213	20,605	74,300
1992	28,083	12,300	13,500	24,056	77,939
1993	26,324	11,199	11,300	32,396	81,219
1994	27,879	9,702	8,200	36,904	82,685
1995	22,856	7,336	8,200	43,449	81,841
1996	22,905	6,401	13,800	38,405	81,511
Yearly Average	26,284	12,087	10,555	28,659	

Source: OPL 1998.

Note: Data may not include rail shipments used to make up for transport problems with YPL line.

A spokesperson for the Yellowstone pipeline (Thompson 1997) stated that shippers determine the amount of product transported by the Yellowstone line, not the Yellowstone Pipeline Company itself. Without a large increase in demand from shippers for some reason, the line would not expand significantly, and would only handle the routine regional growth above what it is currently handling (its share of the market). The Yellowstone line is not now oversubscribed and has no reason to expand. The Yellowstone Pipeline Company has no plans for expansion and would continue to operate under No Action as it does today (Rockwell 1997). It responds to the needs of shippers. This means that the shippers in eastern and central Washington who use the OPL system find it is less expensive and/or more reliable to ship using a combination of the OPL system and trucks and barges, even with proration, than to use the Yellowstone line. There is more excess demand (above capacity) for transport of product through the OPL line than through the Yellowstone line. Therefore, Yellowstone does not appear to offer an alternative means of transport of product other than to compete in part of the same market. It has no plans to carry the volumes proposed by OPL and, of course, it will not carry the product proposed by OPL.

Chevron Pipeline. The Chevron pipeline originates at refineries in Salt Lake City, Utah which refine crude oil from Canada, Utah, and Wyoming. The pipeline is a dual-line from Salt Lake City to Boise with a capacity of 36,000 bbls per day of gasoline in one line and 28,000 bbls per day of jet fuel in the other line. The gasoline line has been at capacity since the early 1990s and the second line only had 4,500 bbls per day of available capacity (i.e., it was 84 percent full to Boise). The pipeline has a capacity of 18,000 bbls per day for a single line from Boise to Pasco and 16,000 bbls per day on the 20.3 cm (8-inch) Chevron pipeline from Pasco to Spokane. Demand for products in

the Salt Lake City and Boise areas has resulted in retraction of deliveries to Pasco. (EAI 1995) As a result, delivery of product to eastern Washington only averaged a total of 6,401 bbls per day in 1996 (Table 2-11). This occurred even when the Yellowstone line was having delivery problems to Washington, because demand in Boise/Pocatello has exceeded supplies.

According to a spokesperson at Chevron Pipeline Corporation (McKee pers. comm.), there is increased production potential in Salt Lake City as a result of increased crude supplies and increased refinery capacity, which will help proration problems between Salt Lake City and Boise and perhaps maintain 8,000 to 12,000 bbls per day west of Boise, some of which will reach Washington. This is an increase of current flow but less than historical flows. This will solve supply problems in Boise/Pocatello but have little effect on supplies in Washington. There are no plans by Chevron to increase this shipping capacity beyond this range. Therefore, the Chevron line will continue to operate at or near current levels with or without the Cross Cascade pipeline. Under No Action, the Chevron line would not replace the capacity of the proposed or existing OPL system.

Thus, the Chevron pipeline would not have the capacity to transport significant loads of additional product to eastern Washington. It also does not provide a means of transporting petroleum products from western Washington refineries to central and eastern Washington. Under No Action, the Chevron line would have no effect on future oil supplied to Washington, other than to attempt to maintain historical flows.

Effect on Shippers. Shippers have indicated and transportation cost studies (USDOT 1994) have shown that trucking is more expensive than barging, and both of those options would be more costly than transport of product by the proposed pipeline (see Sections 2.3.5, 2.4.2.6, and 2.6.1.3). Shippers have contracts to provide product to their wholesale customers at a fixed cost. If they cannot use the existing pipeline and barge system to transport product, because of over subscription of the pipeline (see Section 2.4.2.1) or a temporary closure of river transportation (as occurred with a 4-day closure during high flows in the Columbia River), they must truck product to the wholesaler. The increased costs for shipping by alternative modes of transportation are borne by the shipper.

However, shippers acknowledged that these increased costs are subsequently considered when contracts are renewed with wholesalers. Increased transport costs eventually are a factor considered in new contracts with wholesalers, in the increased cost of product, and ultimately these costs can be transferred to the retail consumer through increased prices for fuel. (Stanley pers. comm.) Thus, increased costs for transporting product to central and eastern Washington under the No Action Alternative via increased trucking would likely result in pressure to increase cost to all users of diesel, jet fuel, and gasoline.

Shippers did not consider the Yellowstone or Chevron pipelines to be viable alternatives to the proposed OPL pipeline because of the lack of capacity, the lack of available supply (see Section 2.4.2.7), or because of their desire to promote the sale of their own products rather than a competitor's products (Stanley pers. comm., Eastlake pers. comm.). The Defense Logistics Agency, Defense Fuel Supply Center (DFSC) stated that it no longer used the Yellowstone pipeline to obtain jet fuel for Fairchild Air Force Base in Spokane because of YPL's lost lease across the Flathead Indian Reservation (Broderick pers. comm.) and conversion to trucking around the reseration. In

1996, the DFSC was using about 35 million gallons of jet fuel annually and had shifted to trucking it from a government terminal in Manchester, WA (located south of Bremerton in western Washington) to assure a reliable source was available. The DFSC indicated it would benefit from, supported construction of, and would use the proposed OPL pipeline to obtain jet fuel if the fuel costs were the "lowest laid down cost." They also stated that the proposed pipeline would provide them additional options for delivery of fuel to other bases such as the Yakima Training Center (Broderick pers. comm.)

Thus, in summary, shippers supported the development of the proposed pipeline because of reduced costs, increased reliability, reduced risk and liability, and the projected increased demand for product in central and eastern Washington (see Section 2.4.2). Shippers have indicated that they have already agreed to ship petroleum products on the proposed pipeline, or have a desire to do so and support construction of the pipeline. (Eastlake pers. comm.)

A major wholesale customer in the Tri-Cities area (name withheld) and a user of the existing OPL pipeline has indicated that the benefits that would be experienced by shippers from the proposed OPL pipeline would also be experienced by the wholesalers. They are experiencing restrictions in delivery of petroleum products because of the over subscription of OPL's existing line. This requires them to obtain additional product from elsewhere. They have also experienced interruptions in availability of product as a result of lock closures several years ago. They feel that the proposed pipeline would benefit them and all wholesalers because it would provide an additional option for obtaining product. The pipeline would increase the reliability of delivery of products to them because they would not have to rely only upon barging to meet their supply needs. It would also assist in keeping prices lower because it would create greater market competition. It would be more cost-effective and efficient because of reduced reliance upon multiple modes of transport (and the associated costs of transfers). As a result of the wholesaler obtaining more cost-competitive product, they are able to reduce their costs and pass those savings on to their retail customers. They also viewed the pipeline as being a safer transport option than the current system, decreasing the potential for environmental damage and liability for the parties involved in purchasing and shipping the products. They do not view the Yellowstone or Chevron pipelines as viable alternatives because of the lack of supply and the greater transportation and petroleum costs from those pipelines.

Summary. Notwithstanding scoping comments that the future will change the product supply picture in eastern Washington, owners of the two lines have confirmed that neither the Yellowstone nor the Chevron pipeline has expansion plans into Washington and neither has a need to expand capacity. Both spokespersons confirmed that their delivery capacity is determined by shippers' demand, that demand is not currently requiring an increase in capacity, and that the decisions of shippers as to which product is ordered, shipped, and sold is the driver affecting the need to expand or modify operations, not the plans of the pipeline companies themselves. In the case of Chevron, the supply is currently not there to meet the demand anyway, nor will it be after system expansion to Boise. Neither line has plans to meet the demands that would be satisfied by the OPL proposal and, of course, neither line could deliver northwest refinery products to meet the need.

The new Express Pipeline from Canada to the Rockies has been mentioned as a source for a major supply picture change. The spokesperson for the line, however (Murphy pers. comm.) said that 80 percent of its flow goes to the Rockies and Midwest with less than 20 percent (18,000 bbls

per day) toward Salt Lake City. The spokesperson felt the line would have no effect on Washington supplies.

2.5 PROJECT SITING OPTIONS

This section discusses alternative pipeline alignment and siting options. Alternative projects that do not meet the need are discussed in Section 2.6.

As part of preparing the project proposal and attempting to avoid or minimize impacts, OPL has evaluated options for approaching and crossing the Columbia River, micrositing along the other segments of the pipeline (including around wetlands), locating the terminal, and locating the pump stations. These options and their relative evaluations are provided below.

2.5.1 Columbia River Approach Options

OPL originally selected a pipeline corridor across the U.S. Army Department of Defense Yakima Training Center located south of I-90 in Kittitas and Yakima Counties in central Washington. The Department of Defense raised early concerns about potential conflicts between the pipeline and the potential movement and training activities of heavy tracked armored vehicles (up to 72 tons each) across the line. As a result, OPL investigated the following options in that area (Figure 2-11):

- through the Yakima Training Center (YTC);
- inside the property/fence line of the YTC, closer to I-90; and
- north of I-90 through Ginkgo Petrified Forest State Park.

OPL now prefers the route north of I-90 through Gingko State Park, because the Department of the Army has indicated that the pipeline would be in conflict with training activities and did not desire to provide an easement to OPL. Impacts of the proposed route and the other two options are considered in this EIS.

2.5.2 Columbia River Crossing Options

In its analysis of alternatives, OPL initially evaluated nine options (see Table 2-12) for crossing the Columbia River (OPL 1998). OPL determined that the following options (Figure 2-11) are potentially feasible based upon constructability, cost, and environmental impacts:

- dredging north of the I-90 Bridge ($10.0 million);
- crossing the I-90 Bridge ($6.9 million);
- horizontal directional drilling (HDD) downstream (south) of Wanapum Dam ($7.8 million);

- crossing the Burlington Northern Beverly Railroad Bridge ($7.6 million); and
- crossing on Wanapum Dam ($6.9 million).

Table 2-12. Initial Columbia River Crossing Options Evaluated

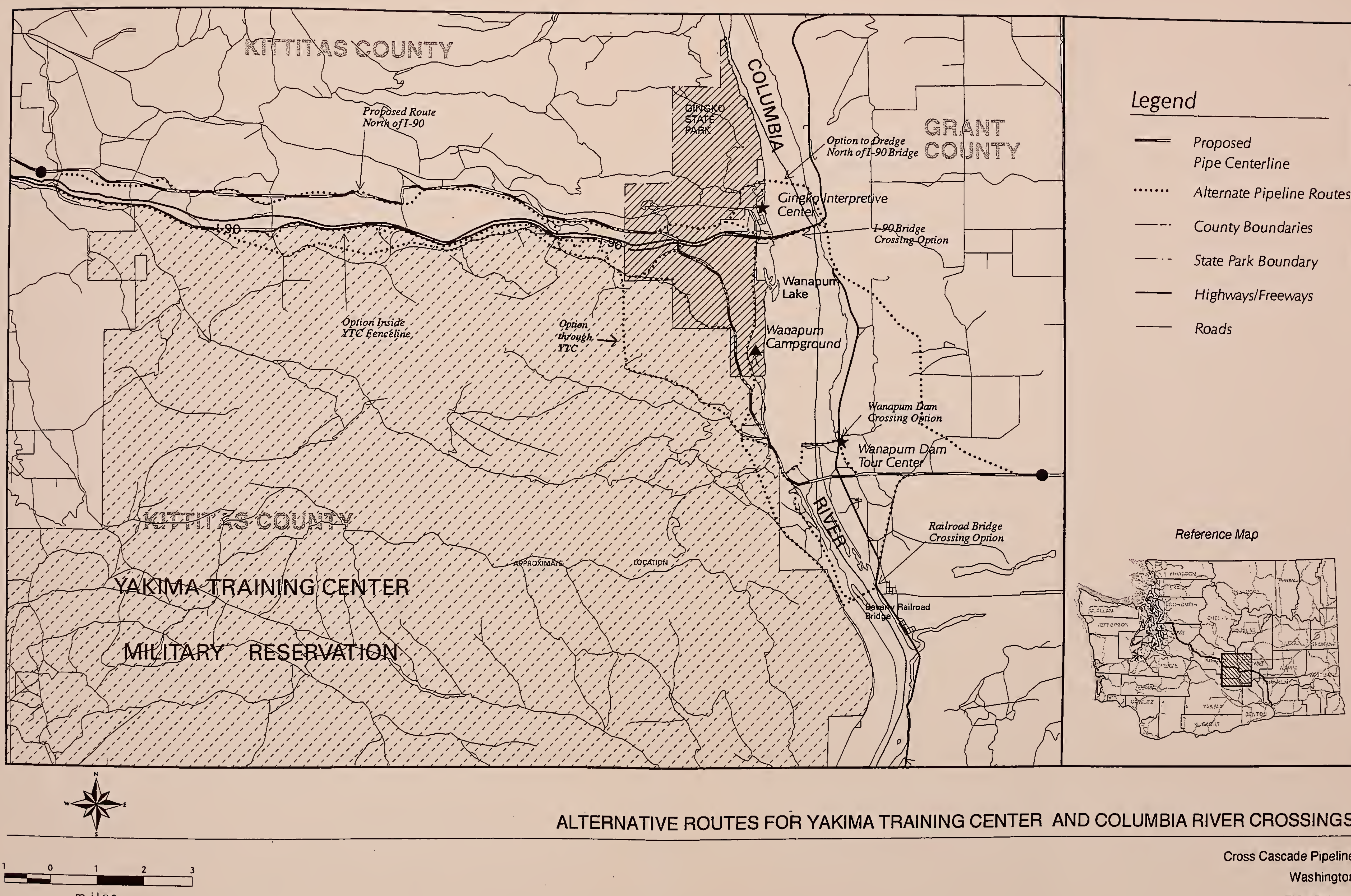
Location	Geotechnical Feasibility	Environmental Impacts[1]	Estimated Cost[2]
Drilling north of I-90 Bridge	unknown	need large cleared area for drilling base	$8.5 million
Dredging north of I-90 Bridge	gravel - feasible	need to minimize impacts to fish habitat and shorelines	$10.0 million
Crossing on I-90 Bridge[1]	structurally feasible	none	$6.9
Drilling south of I-90 Bridge	unknown	no place for drilling base	>$8.0 million
Dredging south of I-90 Bridge	gravel - feasible	need to minimize impacts to fish habitat and shorelines	$10.0 million
Crossing on Wanapum Dam[1]	structurally feasible	none	$6.9 million
Drilling south of Wanapum Dam	gravel - feasible	need large cleared area for drilling base	$7.8 million
Dredging south of Wanapum Dam	gravel - feasible	need to minimize impacts to fish habitat and shorelines	$7.0 million
Crossing on Beverly Railroad Bridge[1]	structurally feasible	none	$7.6 million

[1] Structure owners have not granted permission to use their structure.
[2] All costs are based on routes beginning at Stevens Road east of Kittitas Terminal and ending at the Beverly-Burke Pump Station.

Source: OPL 1998.

OPL's preference is to perform directional drilling downstream from Wanapum Dam. The geotechnical investigation of the proposed Columbia River crossing site indicated that there was a moderate level of risk associated with attempting an HDD installation. While the site conditions are not optimum for an HDD installation, OPL believes the technology exists to complete the installation with a low probability of fracturing out. OPL's decision to propose the HDD installation is based on its belief that an HDD installation at this site would result in the most secure, lowest risk operation. Various regulatory agencies have expressed general concern about the potential for impacts to the river from a small leak that goes undetected for a long period of time. OPL believes its existing pipeline crossing under the Columbia River near Vancouver, Washington, which has been in place without incident for over 30 years, provides a practical demonstration that a buried pipeline crossing that is properly designed, installed, and maintained is environmentally sound. Geological conditions below the Columbia River are different at Vancouver than they are at Wanapum.

The crossing of the I-90 Bridge, the Beverly Railroad Bridge, or Wanapum Dam depends on OPL's success in obtaining authorization from the Washington State Department of Transportation,



ALTERNATIVE ROUTES FOR YAKIMA TRAINING CENTER AND COLUMBIA RIVER CROSSINGS

Cross Cascade Pipeline
Washington
FIGURE 2-11

the Washington Parks and Recreation Commission, or Grant County PUD. None of the owners have stated a position in writing. It is OPL's understanding that the use of any of these structures is a real property issue that is separate from the federal and state permitting processes applicable to the project.

OPL has entered discussions with Washington State Department of Transportation (WSDOT) about the possibility of using the I-90 Bridge; to date WSDOT has not made a decision about the acceptability of using the bridge. This would be the least expensive of the alternatives and would likely have the fewest environmental impacts.

Use of the Beverly Railroad Bridge would require obtaining permission from Washington State Parks and Burlington Northern Railroad, who is considering reactivating the bridge for railroad traffic. The potential for future railroad use, the greater length of exposed pipeline, and the unknown but questionable structural integrity of the bridge all reduce the desirability of this option. Without proper rehabilitation of the bridge and abutments, this route might also pose an operational risk of pipeline rupture above the river resulting from damage to the bridge by seismic shaking.

OPL has also applied to Grant County Public Utility District for authorization to place the pipeline along the upper portion of Wanapum Dam. However, no decision has been made to date as to whether such authorization would be approved.

OPL is continuing to pursue these options, but currently views them as unavailable alternatives. In terms of cost, the HDD alternative below Wanapum Dam does not differ significantly from most of the other potential alternatives. Overall impacts of these three alternatives are similar. All involve an exposed crossing, trenching along the Columbia, and similar habitat. All require crossing through Ginkgo Petrified Forest State Park or the Yakima Training Center. Crossing under the Columbia, with its slightly higher potential for undetected leaks, may be contrasted to an exposed bridge or dam crossing, with its slightly higher potential for damage.

A wet trench dredged crossing provides a conventional construction technique; however, it would disturb and release more sediment into the river than the proposal, create some construction access problems on the narrow shoreline east of the river, and would be very difficult logistically with no way to bring needed barges and equipment by water.

2.5.3 Pipeline Micrositing Options

"Micrositing" refers to specific alignment changes made along the proposed pipeline's centerline. The original ASC map atlas prepared in February 1996 presented a proposed centerline based on known issues at that time. Since then, a number of route improvements within the proposed corridor were made based upon additional field studies and after consultations with federal, state, and local agencies and property owners. Micrositing of the pipeline will continue to occur to avoid or minimize impacts, and after further consultation with agencies. The criteria used for evaluating optional centerline locations included:

- Preference for use of existing cleared ROW, including transmission line corridors, trails, and roadways.

- Avoidance of high-quality wetlands or wildlife habitat.

- Minimizing impacts at stream crossings by the use of existing bridges.

- Minimizing impacts at stream or river crossings by using the narrowest feasible crossing points.

- Avoidance of land use impacts, such as existing structures, irrigated crop lands, gardens, orchards, and golf course fairways.

- Land owner preferences as to line location.

A discussion of the micrositing of the pipeline is provided in Appendix E. One alternative route segment is considered here in detail. Most others are much shorter. This entailed using a segment of the John Wayne Trail between Alice Creek and the Snoqualmie Tunnel versus using Tinkham Road. This example illustrates the types of balances faced in micrositing the pipeline.

The Tinkham Road option uses more miles of U.S. Forest Service land. Seven streams and one wetland along the Tinkham Road route would have to be trenched alongside the road because the bridges or other road crossings are not suitable for the pipeline. Of these seven streams, Rock and Harris Creeks have little or no fish habitat at the crossing locations, but are near the floodplain of the South Fork Snoqualmie River where fine sediments are more prevalent. Carter and Hansen Creeks are minor fish producers in the reaches of the proposed crossings, but are also in the floodplain, and Hansen Creek has somewhat unstable banks. Humpback Creek is a significant trout producer. Olallie Creek, Crossing 82 (see Appendix D, Table D-1, and Section 3.7.1.3) has trout some distance downstream, but nothing significant at the crossing. The one wetland is associated with Carter Creek.

The John Wayne Trail route is longer, and use of that section of the trail requires placing the pipe on the bridge over Hansen Creek. OPL believed construction and maintenance crews would be at greater safety risk during work on the bridge and there is little assurance that, during the life of the pipeline, the Hansen Creek Bridge would never be vulnerable to a flood such as washed out the Hall Creek Bridge. The culvert system at Olallie Creek is another concern. The creek is diverted through a long culvert at that location, and the railtrail has washed out in the past when a debris flow blocked the culvert. Because of the washout, the trail is significantly narrower and is in a dip at that location. To have room for the pipeline, the downslope side would have to be built up, probably using pilings to hold the fill in place. Another debris flow might again block the culvert, causing the creek to overflow the trail and wash it out again. Protecting the pipeline against such forces is not certain. Considering all these factors, OPL believed that the Tinkham Road route was the better choice for the proposed project (OPL 1998). Recent evaluations of Forest Plan consistency versus this alternative may create a problem for the Tinkham Road option (see Land Use).

2.5.4 Terminal Site Options

Optional sites were evaluated for locating the terminal facility, generally near Ellensburg in the I-90 corridor (Dames & Moore 1997). Three sites were identified by ROW personnel and a third site at the Ellensburg Airport was identified by Kittitas County commissioners. As shown in Table 2-13, the four sites evaluated were:

- A 10.9 ha (27-acre) tract adjacent to the Kittitas exit on I-90.
- A tract near the intersection of State Route 10 and State Route 97.
- A site near Elk Heights.
- County-owned industrially-zoned property at the Ellensburg Airport.

The criteria used for evaluating alternative sites for the Kittitas Terminal were:

- Site must be located near the middle of central Washington to serve as an efficient distribution point for central Washington.

- Site must be located in close proximity to major east-west and north-south highways to provide efficient distribution to central Washington.

- In order to avoid maintaining excessive amounts of back pressure on the pipeline, the site needed to be located in an area of gradual elevation change and far enough east or west of areas such as Elk Heights where there is a rapid elevation gain.

- Adequate site size.

- Availability of electric power at the site.

- Compatible land uses adjacent to the site and along connecting corridors between the site and major highways.

- Availability of existing adequate transportation infrastructure from major highways to the site for tanker truck traffic.

- Ability to purchase the site for the facility and to secure proper zoning.

The Ellensburg Airport site was eliminated from consideration based on the difficult truck access to the regional system, the need to build new roads, safety considerations related to winter driving conditions, the high back pressure in the system that would be caused by the location near the mountains, and the presence of wetlands on the site.

The Elk Heights site was eliminated based on construction costs due to the need to construct 11.3 km (7 miles) of new electrical supply lines, the need to build an electrical substation, and the need to construct major revisions to existing ramps to the interstate system.

Table 2-13. Evaluation of Terminal Site Options

Criteria	Alternative Sites: Kittitas*	SR 10/SR 97	Ellensburg Airport	Elk Heights
System Hydraulic Impact	none	high back pressure	high back pressure	none
Electric Power Availability	0.75 mile to suitable substation need to build feeder two viable suppliers	0.75 mile to suitable substation need substation and feeder upgrades one viable supplier	2-3 miles to suitable substation need substation and feeder upgrades two viable suppliers	7 miles to suitable substation need to build feeder and substation one viable supplier
Land Uses at Site and Along Transportation Corridor	interstate highway highway commercial and agricultural uses	state highway agricultural uses	residential residential and agricultural uses	rural residential residential and agricultural uses
Transportation Infrastructure	adjacent to interstate highway very easy access to regional system may need minor revision of ramps good all-weather access moderate volume use for residential and agricultural access	adjacent to state highway easy access to regional system need to build signals or acceleration lane good all-weather access moderate volume use for residential and agricultural access	adjacent to county road difficult access to regional system need to build road section and upgrade intersection dangerous grade for winter driving high volume use for residential and agricultural access	adjacent to interstate highway very easy access to regional system need major revision of ramps good all-weather access low volume use for residential and agricultural access
Property Ownership	purchase from private landowner	purchase from private landowner	lease from public landowner	purchase from private landowner
Wetlands or Sensitive Areas Onsite	none	none	yes	not evaluated

* Selected as preferred site.

Source: OPL 1998.

The Kittitas site and the State Route 10/State Route 97 site were comparable in terms of access to the regional transportation system and access to power. The State Route 10/State Route 97 site was viewed as less desirable due to the high back pressure that would be created in the system based on its location near the mountains and the construction costs to build an electrical substation.

The Kittitas Terminal site was selected as the preferred site.

2.5.5 Pump Station Site Options

The proposed project would have six pump stations, including one at the Kittitas Terminal. Pump stations were generally located based on the needed hydraulics for efficient operation of the pipeline. The criteria for evaluating alternative pump station locations were:

- Appropriate hydraulic location.
- Adequate land area for pump station.
- Adequate existing electrical power supply, or proximity of existing electrical supply.
- Year-round access to site.
- Avoidance of wetlands and other environmentally sensitive areas.

2.5.5.1 Thrasher Pump Station

The Thrasher Pump Station is the origin of the pipeline. Two alternative sites, one at OPL's existing Woodinville Pump Station and a second site on 46th Avenue North, north of 212th Street NE in Woodinville (Thrashers Corner), were considered. The Thrashers Corner site was located directly adjacent to a BPA transmission line corridor, a corridor desired for routing of the pipeline.

The Woodinville Pump Station site is surrounded by residential development and cannot be enlarged. The site was too small to accommodate both the existing and proposed pump stations. Also, the site is approximately 3.2 to 4.8 km (2 to 3 miles) from the BPA transmission line corridor. This additional mileage would have added approximately $1 - 1.5 million in construction costs.

The Thrasher Pump Station site was selected as the preferred pump station location based on site size and immediate proximity to the proposed pipeline corridor. This site also satisfied the criteria of avoiding environmentally sensitive areas.

2.5.5.2 North Bend Pump Station

Six alternative sites were considered for the location of the North Bend Pump Station. The pipeline in this area was proposed to be located on the Cedar Falls Trail. Three sites along the trail were evaluated in or near North Bend, one on the north side of the trail at SE 120th, one directly to the south on the south side of the trail, and a third location near I-90. A fourth location was reviewed further to the east near Edgewick Road. The sites near I-90 and Edgewick Road were eliminated due to the lack of electrical power. Two additional sites approximately 3.2 km (2 miles) further to the east were considered. Neither site had an adequate power supply, and one site would not be accessible during the winter months.

The two sites near SE 120th were viewed to be equal in terms of power supply, access, and site size. Neither site has wetlands nor significant wildlife habitat. The southern site was selected based on the landowner's willingness to grant an easement for both the pipeline and the pump station.

2.5.5.3 Stampede Pass Pump Station

The Stampede Pass Pump Station was located at the intersection of Stampede Pass Road and the John Wayne Trail. The proposed pipeline alignment for this segment was within the trail. There were no alternative sites in this vicinity with power, access, or adequate land area.

2.5.5.4 Beverly-Burke Pump Station

After crossing the Columbia River near Vantage, the proposed pipeline corridor travels east along Beverly Burke Road. There was only one site identified in this area that was of suitable size, with adequate power and access, and available for sale. The site is directly adjacent to Beverly Burke Road approximately 6.4 km (4 miles) east of the Columbia River.

2.5.5.5 Othello Pump Station

The Othello Pump Station site was located on Mound Road just to the north of State Route 246 near the boundary between Adams and Franklin County. The site was on the proposed pipeline corridor. No alternative sites were found in this area with adequate land size, access, and power, and available for sale.

2.6 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

As described earlier in this chapter, this EIS evaluates the potential impacts of two alternatives: the Cross Cascade pipeline proposal and No Action. In the process of developing the alternatives, other options have been evaluated and eliminated from further detailed study in this EIS. This includes two tiers of alternatives:

- Project Alternatives
- Project Corridor Alternatives

Alternatives to the project that were determined not to meet the need are discussed below under "Project Alternatives" and include the following:

- Rail Transport
- Demand Management
- New North-South Pipeline
- Other Means of Transport

Alternative project corridors considered but eliminated from detailed study are potential west-east routes for placing the OPL pipeline (see "Project Corridor Alternatives" later in this section). These alternative corridors were evaluated relative to the proposed pipeline route and included:

- two Snoqualmie Pass Routes
- Yakima Valley Route
- Stampede Pass Route
- two Stevens Pass Routes

The two tiers of alternatives were evaluated with increasingly detailed and stringent evaluation criteria that were commensurate with the level of data available at each stage in the screening process. Initially, the project alternatives were generally evaluated based upon the criteria of cost-effectiveness, efficiency (of construction, operation, and transport), and environmental soundness (or level of impacts). Cost-effectiveness was the dominant screening criterion for projects. Those that cost more than No Action would not be used by shippers and were infeasible and not cost-effective.

Once the project alternatives evaluation was completed, and a west-east pipeline was selected as the alternative best meeting the Purpose and Need, alternative pipeline corridors were evaluated with more criteria and a greater specificity of information. Six criteria were used to evaluate seven corridors (including the proposed route). The similarity in characteristics of pipelines, despite their locations in different sites, allowed a more detailed point-by-point evaluation. Thus, the same cost-effective needs screening that was done for the project alternatives (i.e., cost of transport per barrel no more than No Action) was not applied to the corridor alternatives. It is assumed that any pipeline corridor alternative is cost-effective compared to No Action.

2.6.1 Project Alternatives

2.6.1.1 Railroad Transport from Woodinville or Portland to Pasco

Rail transport is not cost-effective for shipping petroleum products to central and eastern Washington, which probably explains why no one has proposed it. There are several existing rail lines between northwestern Washington and central and eastern Washington, providing alternative routes for transporting product. However, this form of transport is not being used by shippers because it is not cost-effective compared to trucking or barging of petroleum products from either Woodinville or Portland. The estimated cost of rail product transport from the Seattle area to Pasco is $3.45 per bbl (see Table 2-9) (OPL 1998) assuming there are facilities and terminals to handle rail offloading at Pasco terminals, which there are not.

There are no proposals to ship product from the refineries by rail. Rail operation, if proposed, would require loading operations at points unconstrained by delivery capacity such as in Snohomish County, and would require offloading facilities at the Northwest Terminalling Facility. Reliable rail service could be disrupted by landslides or derailment of other trains using the same track.

Because it is too expensive, would not be used, has no petroleum handling infrastructure, and is considered remote and speculative because no one is proposing it, rail operation does not meet the Purpose and Need and is not evaluated in detail as an alternative.

2.6.1.2 Demand Management

Product Conservation. Federal requirements establish the fuel efficiency requirements for vehicle fleets manufactured by major auto makers. These requirements, plus the public demand for fuel-efficient cars, have resulted in fuel savings since the 1970s oil crisis. However, overall petroleum product consumption continues to increase and more crude oil is imported today than before the oil crisis. In addition, to meet the demands of airlines and operating/cost efficiency, aircraft have become more fuel efficient. Although many gains have been made in conserving petroleum products in the last 25 years, demand has increased.

Although more successes in this area are possible, each additional unit of conservation costs incrementally more to implement. It is also difficult to encourage switching to mass transit, car pooling, or other forms of transportation in rural areas like central and eastern Washington because of the costs of such programs in relatively unpopulated areas. Thus, the opportunity to meet substantial additional conservation goals would be minimal and would be outside of the control of OPL. This would also have no effect on diesel consumption from agricultural activities and trucking. The proposal would provide products to consumers after the effects of conservation measures have been felt.

Fuel Switching to Natural Gas. Many of the petroleum products now transported to central and eastern Washington, and that would be transported by the proposed pipeline, are used to fuel personal vehicles, farm equipment, commercial tractor trailers, aircraft, and other vehicles. Switching all or a substantial number of this motorized transport to use natural gas might not be technically feasible, would be very costly, would require a number of individuals and businesses to change the means of obtaining fuel and operating their equipment, and would not be within the capabilities of OPL.

The main residential energy modes used for heating, cooking, water heaters, dryers, etc., are electricity and natural gas. Switching from home heating oil to natural gas would have little effect on OPL. Such switching may also increase demand for gas pipelines. The alternative of demand management does not meet the Purpose and Need and is not evaluated in detail as an alternative.

2.6.1.3 New North-South Pipeline System Alternatives

The north-south alignment is discussed here as a project alternative instead of a corridor alternative because it does not achieve the goals of the project in the same way as the proposal and is more than just an alternative route. It is an alternative to the project. Instead of another means to carry products directly to central and eastern Washington, like the alternative pipeline corridors discussed later in this chapter, a north-south line is more similar to the current situation: it encompasses transfers at Portland, barging up the Columbia River, trucking on Snoqualmie and

Stevens Passes, and it expands the north-south transmission capacity. New north-south alternatives eliminate proration problems, but do not offer shippers lower cost deliveries to central and eastern Washington.

Before evaluating the north-south alignment alternatives, each is described within the context of how it might meet the need. An important factor in that need is that shippers are requesting a lower cost alternative than barging and trucking. Another is that the demand to which the applicant is responding is not just a growth in demand, it is a growth in demand from central and eastern Washington. The existing pipeline was built to serve western Washington, including anticipated future western Washington demand. That was more than 30 years ago and the situation is now beyond the period of supply and demand predictions made then. This growth has triggered a need for more eastbound barges and tanker trucks that did not exist before. This creates a need for a transport system that handles projected demand from, and delivery to, central and eastern Washington, as well as western Washington. Shippers have requested that such a system be provided at lower cost. The existing systems are meeting all supply needs. The proposal, and alternatives to it, must meet cost-effective, efficient, environmental, and long-range needs.

Each north-south alternative is described with consideration for meeting those needs. There are four north-south alternatives considered, in addition to increased throughput of the existing line. Two involve replacing the existing line; two involve a second, parallel line:

(1) Increased throughput of existing line
(2) New replacement line in the same ROW
(3) New replacement line outside of ROW
(4) Parallel line serving eastern Washington alone
(5) Parallel line connected to existing line

There are differences among these alternatives in terms of cost, efficiency, environmental soundness and feasibility. All suffer from two major problems compared to the proposal: cost/feasibility and efficiency. These five alternatives are discussed in detail below. Transportation costs for alternatives are provided in Table 2-14.

(1) Increased Throughput of Existing Line. The existing line carries 174,500 bbls of product to points between Renton and Portland. This volume was achieved in 1995 when additional pumping capacity and polymers (drag reducers) were added to attempt to keep up with demand. The existing demand over and above this capacity is 44,500 bbls at existing tariffs (OPL 1998). (This could go down with higher shipping costs and vice versa.) With pump upgrades and more polymers at a cost of $6 million, the flow could be increased by 3,000 bbls per day to 177,500 bbls. This cost for this improvement is far from cost-effective and does not meet the need of 44,500 bbls, so it is impracticable from a cost and logistics standpoint.

For this reason, upgrade and future improvements to the existing line are not practical and this alternative is not further evaluated in the EIS.

Table 2-14. Transportation Costs of Alternatives (in dollars per barrel)

Cost Elements	Existing System	Isolated Independent Line	Connected "Looped" System	Ocean Barge Alternative	Cross Cascade Pipeline
Pipeline Transportation	0.45	2.85	0.83	0	1.25
Ocean Barge Transportation	0	0	0	1.04	0
Terminal at Portland	0.25	0.25	0.25	0.25	0
River Barge Transportation	1.17	1.17	1.17	1.17	0
Terminal at Pasco	0.27	0.27	0.27	0.27	0.27
Total	2.14	4.54	2.52	2.73	1.52
Incremental Over Existing	0	2.40	0.38	0.59	(0.62)

* OPL has provided costs of $0.25 and $0.27 for terminal charges at Pasco.

Source: Lynch pers. comm.

(2) New Replacement Line in the Same ROW. A replacement line would be a 40.6 to 50.8 cm (16- to 20-inch) line with much greater capacity than the existing line. This line would carry all the product needed by western Washington customers and eastern (Pasco area) customers but would not deliver to central Washington, leaving the truck traffic across Snoqualmie Pass to continue and to grow in the future.

Replacing the line in the same ROW would require shutting down the existing line frequently during construction because it would use the same trench or be so close that it would be too dangerous to operate. In most cases, construction could not occur during operation, so the more often the shutdowns, the faster the construction, and vice versa. OPL has estimated that the project could be built in 19 months if the pipeline were shut down 80 percent of the time, and completed in 76 months if shut down only 20 percent of the time. Complete shutdown could build the project in 12 months. Revenue loss to OPL for any shutdown scenario is $27 million. Because shippers would revert to higher costs of transport during shutdown, they would incur up to $51 million in additional shipping costs via barge, trucks, rail, or ocean tankers, compared to pipeline costs. Some product terminals, which are designed for pipeline use and cannot receive marine traffic, would have to close down whenever the pipeline was shut down during construction. Eight terminals currently do not have capacity for the larger line and would have to pay to expand their facilities and pass on those costs. All shut down-related costs would occur over a 1- to 6-year period, depending upon which construction scenario is chosen.

This construction scenario would also require temporary pump stations which would be replaced for the new permanent line as they are too small for permanent operation. It would also include the risks of working next to a continually operating petroleum filled pipeline.

The existing ROW, which appears as a likely location for a new line, only exists as a legal ROW and easement for the old line and is not an existing ROW for a new line. OPL would have to

negotiate new agreements with property owners to use it. Also, there is considerable development along the existing ROW which increases costs of construction. Approximately 20.9 km (13 miles) of ROW is less than 3 m (10 feet) in width and would preclude placing a second pipeline within the existing ROW even if property owner agreements could be obtained. The pipeline would require new ROW in these areas.

In terms of meeting the criteria under Purpose and Need, this alternative is not cost-effective because it would cost shippers more than they are paying now so they wouldn't use it. In addition, it would cost OPL an additional $27 million in revenues while shut down, increasing the project cost by more than 20 percent, cost shippers an additional $50 million in transportation costs during construction, and is not as efficient as the proposal because it still requires the use of barges and trucks with their attendant risks, accidents, and possibilities of fatalities.

From an environmental perspective, a new north-south line would cross 150 roads and highways, 55 waterways wider than 30.1 m (100 feet), 8.9 ha (22 acres) of wetlands (unless avoided by leaving the ROW), hazard areas and contaminated areas, all of which increase costs or would require rerouting which increases costs.

The logistics issues associated with construction, costs to OPL of shutdown for a 1- to 7-year period, additional costs to terminals, lack of elimination of the logistics problem with trucks over Snoqualmie Pass, and most importantly, the fact that shippers would not use it due to increased cost prevent this alternative from meeting the need or being further considered.

(3) New Replacement Line Outside of ROW. This is a large-diameter single line replacement to Portland. One of the major potential benefits of a north-south option is using the existing ROW to avoid new ROW impacts. However, all of those benefits are lost with this alternative. This alternative could be built with potential impacts to roads, rivers, public uses and other impacts, but it appears that the more important factor in evaluating this alternative is its ability to meet Purpose and Need.

It is not cost-effective because it would not result in the same or lower costs to shippers. Shippers in central Washington would continue to use trucks because this alternative would not improve their situation by providing more direct access to product. Shippers in western Washington would pay more because they would get their product from a new expensive line that they must pay for instead of the existing line. For reasons of efficiency, cost-effectiveness and logistics, this alternative does not meet the Purpose and Need.

(4) Parallel Line Serving Eastern Washington Alone. To avoid affecting westside customer costs, this line (built at a cost similar to either replacement line discussed above) would only carry eastern Washington volumes. Shippers could use it, or use the other line in conjunction with barge and truck. All shippers always have their choice.

This line would require a new pump station, a new pipeline, truck loading facilities in Seattle, and barge loading facility in Portland or Vancouver, at a cost estimated by OPL to be $125 million to carry 50,000 bbls per day. This parallel line would still load onto Columbia River barges. The cost is more than the proposal because of the new support facilities and because of the considerable

additional high-density developed area crossed by the pipeline compared to the proposal. The 50,000 bbls per day would come from the 23,500 bbls per day now coming up the Columbia River (out of the existing line) and 26,500 bbls per day in anticipated new volumes (volumes assumed to be desired based on commitments made through the proposal). It would have a tariff of $1.51 per barrel if it operated at those volumes. However, because shippers in eastern Washington can receive 23,500 bbls per day from the existing line for $0.45 per barrel (barge costs are the same for both options), they would only consider using the new parallel line for the product volumes in excess of that capacity. This would change the throughput of the new line from 50,000 bbls to 26,500 bbls at the same construction cost. Tariffs on a line with only 26,500 bbls passing through it would be $2.85 per barrel. At this price, it would be cheaper for eastern Washington shippers to order ocean barges directly from the refineries and increase barge traffic than to use the line. Total costs at Pasco for this alternative would be $4.54 per barrel or $2.40 more than the existing system (Table 2-14).

This alternative is not direct (efficient) and also does not serve central Washington. It would not be used by shippers and does not respond to the need. Because this does not meet the cost-effective criteria and it would not be used if built, this alternative is not practicable and is not brought forward.

(5) Parallel Line Connected to Existing Line. Another option is to build a second line and interconnect it with the existing line so that they may operate as one larger line. Aside from the environmental impacts of constructing such a line, which would be the same as the other north-south lines, OPL has calculated that costs to shippers from such a system are greater than the existing system. OPL has estimated that the cost of such a line would require a tariff of $0.83 per barrel to get it to Portland (Table 2-14). This compares to $0.45 per barrel now, an 84 percent increase. OPL feels that some shippers with options would seek other sources, lowering OPL revenues. The 84 percent cost increase amounts to $21 million in western Washington, and OPL feels that they would not prevail in a rate case at this level, by providing essentially the same service at such an increased cost.

Eastern Washington shippers may incur an 18 percent increase in costs from this option compared to today's costs. They would not likely dispute that number at OPL rate hearings, except that the increased cost would not improve reliability because barges would still be required as part of the system. In either case, trucks would still deliver products across Snoqualmie Pass to supply central Washington at costs paid today.

Under this alternative, shippers would pay more for product they are getting now instead of less, impacts of building a new north-south line would still be felt, and barging of product would continue up the Columbia River. From a logistics standpoint, cost-effective standpoint, and efficiency standpoint, these two secondary line alternatives do not meet the Purpose and Need.

Summary of North-South Alternatives. All of the north-south alternatives would increase delivery costs to eastern Washington and, as a result, are not practicable. It is possible that the Columbia or Snake Rivers may be drawn down for significant periods of time to enhance salmon passage, especially as new endangered species listings occur. This is a hypothetical situation at this time, but it is possible, and does not add to the north-south line's ability to meet the long-range needs for getting product to eastern Washington.

The north-south lines, with required barging and trucking components, would not meet the long-range needs of transport to eastern Washington as well as the proposal. In fact, each year that demands grow in eastern Washington, there will be more demand for barging and more demand for trucking over Snoqualmie Pass when closer to the delivery point than Pasco. The longer the window of operation of the north-south system, the less responsive this alternative is to meeting that need. A more responsive alternative would be one which provides product to all customers, without prorating, without other modes of transport, without handling, and without greater and greater use of other mechanisms of handling and transport over the long term. This can be met by a single west-to-east system of transport such as the proposal.

For the reasons discussed at the beginning of this section, the second north-south line has been eliminated from further consideration because its tariff costs to customers would eliminate its usefulness.

The north-south replacement line is likely to reduce existing pipeline spill risk by eliminating the other, older line, but brings with it minor increased risk due to barge operations and moderate increased risk due to trucking. It does not meet the long-term needs of shippers to eastern and western Washington as well as the proposal and, in fact, has several deficiencies in that regard: it requires multiple modes and more over time, it is less reliable, it is at risk from major operational changes to the river, and is not as responsive to needs in eastern Washington. It costs more than No Action to shippers and therefore, is not cost-effective. It does not meet central Washington needs. For these reasons, the north-south line alternatives are excluded from further analysis in this EIS and are not brought forward for further detailed study.

2.6.1.4 Other Means of Transport

Options such as all trucking, all barging, and other combinations all cost more than No Action and are not cost-effective or feasible. They are currently available to shippers.

2.6.2 Project Corridor Alternatives

The costs of constructing and operating a pipeline are largely dependent upon its length and change in elevation. Increasing the length of a pipeline directly increases the amount of materials and labor required, and may require adding more pump stations or increasing the diameter of the pipe to compensate for the additional frictional losses. Each of these items adds to the pipeline's construction cost. If the size of the pipe is not enlarged, the increased length would also result in consumption of larger amounts of electric energy during operation to compensate for the additional frictional losses. The estimated cost effects of these elements are approximately:

- $460,000 per mile of pipeline on generally level ground;
- $2 million for each pump station;

- $32,000 per mile to enlarge a pipeline by one standard diameter (the next larger size); and

- $36,000 per mile-year to increase the length of a pipeline while holding the diameter constant.

The cost of construction and operation also depends on the elevation profile of a pipeline route. Increasing the total elevation gain of a route or increasing the number of elevation gains and losses results in a longer route, a need for more pump stations, and increased construction costs. High points and sudden elevation losses near the end of the pipeline segments create the need to maintain higher than normal back pressures, resulting in consumption of larger amounts of electric energy and higher operating costs.

Elevation changes, length, and routing also affect the constructability of the pipeline, access to it, cost and time associated with obtaining ROW, and the environmental impacts.

Based upon the above costs and factors, OPL used the following six criteria to screen and evaluate potential alternatives for pipeline routing:

- length of the pipeline (a cost and efficiency issue);

- elevation profile and its effects on the number of pump stations required (a cost and efficiency issue);

- constructability (an efficiency issue);

- pipeline access (a cost issue);

- environmental impacts; and

- ownership/land use (an impact issue).

More details about the evaluation of route alternatives are provided in Appendix E and are summarized in Table 2-15. The following briefly describes the two Snoqualmie Pass Routes, Yakima Valley Route, Stampede Pass Route, and two Stevens Pass Routes that were considered.

2.6.2.1 Snoqualmie Pass Routes

Two alternatives to the proposed pipeline for routing through Snoqualmie Pass were considered. The Centennial Trail Alternative would begin at Thrashers Corner; follow a BPA corridor; cross the Snoqualmie River; then use a railroad ROW that generally parallels State Route 23, crossing Snoqualmie Pass and the Columbia River, to a point just east of Royal City; and then turn south to follow the same route as the proposed project. This route would be 24.1 km (15 miles) longer, have the same number of pump stations, be more difficult to construct because of the narrow

Table 2-15. Alternative Pipeline Route Evaluation Summary

Route	Pipeline Length (miles) and Cost (millions)	# of Pump Stations	Constructability	Pipeline Access	Environmental Impacts	Ownership/Land Use
Allen Station via Stevens Pass to Pasco	285 $133.0	8	less constructable than Snoqualmie Pass routes	difficult	4 river crossings: Columbia, Snohomish, Skykomish (6 times), Wenatchee	7 cities: Monroe, Sultan, Gold Bar, Index, Leavenworth, Cashmere, Wenatchee
Snohomish via Stevens Pass to Pasco	240 $125.0	7	less constructable than Snoqualmie Pass routes	difficult	4 river crossings: Columbia, Snohomish, Skykomish (6 times), Wenatchee	7 cities: Monroe, Sultan, Gold Bar, Index, Leavenworth, Cashmere, Wenatchee
Thrashers Corner via Snoqualmie Pass to Pasco	230 $105.1	6	more constructable than Stevens Pass routes	easy	4 river crossings: Snoqualmie (4 times), Tolt, Columbia, Yakima	3 cities: North Bend, Snoqualmie, Kittitas (North Bend and Snoqualmie on trail)
Thrashers Corner via abandoned railroad route (Centennial Trail) and Snoqualmie Pass to Pasco	245 $115.0	6	more constructable than Stevens Pass routes	moderate	4 river crossings: Snoqualmie (4 times), Tolt, Columbia, Yakima; Significant wetland impacts along Centennial Trail	7 cities: Duvall, Carnation, North Bend, Snoqualmie, Kittitas, Ellensburg, Beverly
Hollywood via the Tolt Pipeline Corridor and Snoqualmie Pass to Pasco	225 $109.0	8	more constructable than Stevens Pass routes	easy	4 river crossings: Snoqualmie, Tolt, Columbia, Yakima	3 cities: North Bend, Snoqualmie, Kittitas. Conflict with City of Seattle Tolt River Pipeline corridor
Renton Station via Stampede Pass to Pasco	210	8	less constructable than Snoqualmie Pass routes	moderate	4 river crossings: Cedar, Green, Columbia, Yakima	Densely populated south King County. Conflict with Seattle Cedar River and Tacoma Green River watersheds
Yakima Valley	240 $110.0	8	constructable assuming paired with Snoqualmie Pass route	easy	4 river crossings: Snoqualmie (4 times), Tolt, Columbia, Yakima (6 times). Construction impacts to vineyards, orchards, crops	4 cities: Ellensburg, Yakima, Selah, Richland. Land use conflicts due to construction impacts to vineyards, orchards, crops

ROW in the Snoqualmie Valley, be less accessible because of its greater distance from I-90, have more environmental impacts based upon the same number of major river crossings but also have significant wetlands impacts along the trail, traverse four more cities and the associated populations, and cost $10 million more than the proposed project.

The Hollywood Alternative would originate near Hollywood in the Sammamish River valley, follow the City of Seattle's Tolt River Pipeline eastward, cross the Snoqualmie River south of Duvall, connect with the BPA corridor north of Stillwater, and then follow the same route as the proposed project. This route would be 8.0 km (5 miles) shorter, require two more pump stations, be as easy to construct, be as accessible, have similar environmental impacts based upon the same number of major river crossings, and traverse the same number of cities as the proposed project. It uses a corridor that the City of Seattle owns and where a second water line is planned, eliminating space for a petroleum pipeline which eliminates this alternative as an option. It would cost $4 million more than the proposed project.

2.6.2.2 Yakima Valley Route

This route could be used with any of the Stevens, Snoqualmie, or Stampede Pass crossing alternatives, as a variation on that portion of the overall routes. As a variation on the proposed project, west of Ellensburg the route would turn south, go through the Yakima Valley following the Yakima River and crossing it a minimum of six times north of the City of Yakima, then turn southeasterly and south following a BPA ROW. At 9.7 km (6 miles) north of Grandview it would turn east and southeast, cross the Columbia River on the Interstate 182 bridge, traverse north of Pasco, and then turn south to the Northwest Terminalling Facility. This route would be 16.1 km (10 miles) longer, require two more pump stations, be more difficult to construct because of the number of crossings of the Yakima River and irrigation canals, be as accessible, have greater environmental impacts with four more major river crossings and crossing a number of vineyards and orchards, and would traverse four cities in addition to others already crossed by the proposed project. This route alternative would cost more than the proposed project and increase the costs of any alternative it would become a part of because of the additional length of the pipeline; about $5 million more for the additional river crossings ($1 million for each crossing); mitigation costs for passing through vineyards, orchards, and crops (i.e., asparagus) that cannot recover production in 1 year; revegetation costs for the additional grazing lands crossed; and the costs of purchasing the additional ROW easements.

2.6.2.3 Stampede Pass Route

This route would originate at the existing OPL Renton Station (near Interstate 405 and State Route 167), go northeasterly to State Route 169, parallel State Route 169 along powerline and railroad ROWs, turn east crossing State Route 18 just north of Hobart, then follow a BPA ROW southeasterly past Howard Hanson Reservoir and through Stampede Pass, turn southeast to connect with the John Wayne Trail, and then follow the same route as the proposed project. This route would be 32.2 km (20 miles) shorter, require two more pump stations, be more difficult to construct because of more rugged terrain (i.e, steep slopes and rock outcroppings) and higher elevations, be less

accessible because of its remoteness in mountainous areas, and have more environmental impacts with the same number of major river crossings. It would also cross the strictly prohibited City of Seattle Cedar River and City of Tacoma Green River watersheds, and would traverse more densely populated areas in south King County.

2.6.2.4 Stevens Pass Routes

Two potential routes were evaluated for crossing Stevens Pass: the Allen Station Alternative and the Snohomish Alternative. The Allen Station Alternative would begin at the Allen Pump Station about 4.0 km (2.5 miles) south of Burlington; follow the existing OPL ROW until 6.4 km (4 miles) south of Everett where a new pump station would be constructed; turn east and parallel a BNRR ROW through Monroe, Sultan, and Gold Bar; enter a BPA ROW near Index that then parallels U.S. Highway 2; and follow a BNRR ROW from 3.2 km (2 miles) west of the Stevens Pass summit and through the abandoned Old Cascade Tunnel under the pass. The route would then generally follow U.S. Highway 2 and BPA ROWs to Chumstick Creek, turn south and parallel the creek and a county road until reaching Leavenworth, and follow a BPA ROW southeasterly crossing the Wenatchee River east of Monitor and the Columbia River west of Moses Coulee. It would then traverse southeasterly through the Columbia Basin Irrigation Project, intersect State Route 26 east of Royal City and parallel it until 6.4 km (4 miles) west of Othello, and then turn south and follow county roads along the same route as the proposed project to Pasco. This route would be 88.5 km (55 miles) longer than the proposal, have two more pump stations, be much more difficult to construct because of more rugged terrain (i.e., steep slopes and rock outcroppings) and higher elevations, be less accessible because it would be more remote from highways and roads, have more environmental impacts because of five additional crossings of major rivers, traverse four more cities and the associated populations, affect more motorists in the relatively narrow U.S. Highway 2 corridor, and would cost $28 million more than the proposed project.

The Snohomish Alternative would tie into the existing OPL pipelines/corridor 6.4 km (4 miles) south of Everett and then follow the same route as the Allen Station Alternative. This pipeline would be 72.4 km (45 miles) shorter than the Allen Station Alternative and 16.1 km (10 miles) longer than the proposed project; have one less pump station than for the Allen Station Alternative but one more pump station than for the proposed project; would have the same constructability, access, and environmental impacts as the Allen Station Alternative; and would cost $20 million more than the proposed project.

Chapter 3. Affected Environment, Environmental Consequences, and Mitigation Measures

3.1 INTRODUCTION

This chapter describes the affected environment (existing conditions) and impacts of the proposed project (with mitigation proposed by OPL as part of the project, as described in Chapter 2). The affected environment discussions summarize information obtained from the amended ASC (OPL 1998); federal and state agency databases, reports, and telephone calls; site visits; and other sources. Sections focus on the main geographical and topical issues of concern. For additional information and details, the reader is referred to the ASC.

Impacts of the project are evaluated in the "Environmental Consequences" subsections assuming that the mitigation proposed by OPL (e.g., best management practices, revegetation, provision of firefighting capabilities, and so forth) is part of project design, planning, construction and operation. Additional mitigation measures beyond those proposed by OPL are suggested if appropriate, together with their potential effect on impacts.

The No Action Alternative assumes that the existing Seattle-Portland pipeline would continue to operate, as it would with the proposal. The No Action Alternative would keep the petroleum product delivery system at a dynamic status quo, which means that the existing pipeline system would remain, and more barges and trucks would be needed to meet demand for product transportation. Therefore, the existing Seattle-Portland pipeline system is a constant with or without the proposal, and the principal difference between No Action and the proposal is that the proposal eliminates most trucking and barging and includes a pipeline, while No Action retains current truck and barge activity and increases them annually above current levels. Impacts of the existing Seattle-Portland pipeline are not discussed in detail with or without the project because they are the same in either case.

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3.2 GEOLOGY, SOILS, AND SEISMICITY

3.2.1 Affected Environment

3.2.1.1 Geology and Geomorphology

Table 3.2-1 describes the geology of the pipeline corridor. Information in the table is primarily based on a compilation of published geologic maps, supplemented with local aerial photo analysis and ground reconnaissance. The map atlas in Appendix A of the ASC shows the distribution of soil and rock units along the corridor (OPL 1998).

3.2.1.2 Soils and Erosion, Mass Wasting, and Landslides

Soils and Erosion. The physical characteristics of a soil (e.g., grain size, sorting, density or degree of compaction, and composition) dramatically impact its mechanical behavior with respect to erosion, mass wasting, and liquefaction potential. The type of soil that has formed or been deposited in an area is also an indicator of the surface processes that have affected (and may continue to affect) the area. This subsection addresses soil type with respect to erosion potential; mass wasting and liquefaction are discussed in later subsections.

The soil types along the pipeline corridor are shown on the soil types and erosion hazard maps in Appendix B of the ASC. These maps also indicate the relative susceptibility of the various soil units along the pipeline corridor to erosion. Soil units that have moderate or high potential for soil erosion are delineated based on soil type, physiographic setting, and drainage conditions. The soil units and erosion designations shown on these maps are from soil surveys of the Natural Resources Conservation Service (NRCS).

Soils along the pipeline corridor can be divided into two general types based on their geographic position and genesis:

- Soils west of Ellensburg are generally associated with glacially deposited materials, materials weathered from bedrock, and sediments deposited in alluvial valleys. These soils, because of their physical properties and the climatic environment in which they are situated, are impacted primarily by water-related erosion.

- East of Ellensburg, the soils consist of wind-blown silt and sand, materials weathered from bedrock, alluvium, and Pleistocene flood deposits. These soils are subject to both water- and wind-related erosion because, in general, they are finer grained than the soils to the west, often are not as well consolidated, and occupy a drier environment.

Areas of identified high erosion potential along the pipeline corridor include steep sidewalls of creeks and river drainages, alluvial soils in the larger stream valleys, and windblown silt (loess soil) in eastern Washington. Between the proposed Thrasher Pump Station and North Bend, areas of high

Table 3.2-1. Geology and Geomorphology along Pipeline Corridor

Pipeline Segment and Mileposts*	Description
Thrasher Pump Station to Snoqualmie MP 0 to MP 33	This segment would traverse the Puget Lowland, a structural basin filled with a thick sequence of unconsolidated sediments. The relatively level basin fill was subsequently dissected resulting in a network of creeks and rivers with steep side slopes. Geology along this segment (Map Atlas pages 1 through 14) consists predominantly of unconsolidated deposits laid down during most recent glaciation (Vashon Stade of the Fraser glaciation). This glacier originated in the area that is now British Columbia and covered the central Puget Lowland between about 15,000 and 13,500 years ago (Easterbrook 1986; Booth 1987). Vashon ice sheet eroded topography and deposited sediment transported by the advancing ice mass and meltwater streams. Layered strata of clay, clayey silt, silt, sand, gravel, and boulders were deposited. Deposits are very dense or hard where they were overridden by glacial ice, and loose to medium dense or soft to very stiff where they were not overridden. As few as three and perhaps as many as five glaciers deposited sediment (Qpf) prior to the most recent Vashon Stade glaciation. Glacial outwash (Qgo), consisting of granular soil deposited by streams and rivers flowing from the glaciers, was deposited both during advance and recession of glacial events. Glacial outwash is exposed throughout this area, most commonly within present-day stream valleys. Glacial outwash typically is moderately dense where it overlies the most recent glacial till and very dense where it underlies this till. Sediments deposited at the base of glacial ice mass were overridden and consolidated to form a very compact deposit known as glacial till (Qgt). Till is generally present near ground surface along much of this segment and at Thrasher Pump Station. Post-glacial alluvial deposits (Qa) along this segment occur in stream and river valleys, most notably in Snohomish River, Cherry Creek, Tolt River, and Snoqualmie River Valleys. They typically consist of sand, gravel, silt, and clay deposits having low to moderate densities. Deposits can range in thickness from a less than a meter in small stream valleys to several tens of meters thick in larger river valleys. Mass wasting deposits (Qls) have been mapped on steep slopes on south sides of Cherry Creek (atlas page 8) and Tolt River (atlas page 11). They are discussed in text with respect to potential impacts on the project. Isolated exposures of sedimentary bedrock (Ts) occur throughout this segment. The longest segment that would pass through exposed bedrock extends 7.2 km (4.5 miles) from Peoples Creek (stream crossing 15 on atlas page 6) to North Fork Cherry Creek Tributary (stream crossing 18 on atlas page 7). Bedrock consists of Tertiary-aged andesite (Tan), a relatively massive volcanic rock that is typically hard in fresh exposures.

Table 3.2-1. Continued

Pipeline Segment and Mileposts*	Description
Snoqualmie to I-90 East of North Bend MP 33 to MP 38	Snoqualmie River Valley, from approximately stream crossing 37 (atlas page 14) to South Fork Snoqualmie River at stream crossing 43 (atlas page 17), is underlain by relatively loose alluvial silt, sand, and gravel (Qa) (Frizzell et al. 1984). The Snoqualmie River is one of the principal east-west rivers draining central portion of Cascade Range. In the vicinity of Snoqualmie, it is a broad floodplain with an underfit active stream channel. Bedrock underlies alluvium at depth, but is expected to occur below anticipated depth of installation for pipeline. Thickness of alluvium is reported to be greater than 15 m (50 feet) in the area of crossing 38 of the Snoqualmie River (atlas page 14) (Dames & Moore, 1977a and 1977b). Groundwater in deposits is relatively shallow and generally coincident with water level in Snoqualmie River.
I-90 East of North Bend to the Western Tunnel Portal MP 38 to MP 55	This portion of Snoqualmie River Valley is U-shaped, formed by scouring of last continental and alpine glacial ice. Valley sides are mantled with glacial deposits that have been incised or overridden by subsequent alluvial fans or landslides that emanate from side channels to main valley.
National Forest Service Lands (MP 45 to MP 55)	Pipeline corridor between crossing of stream 43 east of I-90 (atlas page 17) and western portal of the railroad tunnel immediately east of Rockdale Creek (stream crossing 84 on atlas page 24) is underlain by the following deposits: (1) relatively loose alluvium (Qa) and moderately dense glacial outwash (Qgo) (both consisting of mixtures of silt, sand and gravel) within valley floors; (2) glacial ice contact deposits (Qgi) consisting of relatively compact mixtures of clay, silt, sand, gravel, and minor fill in isolated pockets along the valley flanks; (3) local landslide deposits (Qls) and avalanche deposits (Avl), and (4) bedrock at relatively shallow depths along steeper valley sidewalls. Tertiary-age bedrock has been mapped as marine sandstone and argillite (Tar); volcanics (Tv); granite (Tg); metagabbro (Tmg); rhyolite (Trh); and sandstone, siltstone, shale, and conglomerate (Ts) (Frizzell et al. 1984).
Western Tunnel Portal to the Crossing of the Yakima River MP 55 to MP 102	This segment (atlas pages 24 to 41) extends from steep slopes and rugged terrain at crest of Cascade Mountains to wide-open topography along western edge of Columbia Plateau.
National Forest Service Lands (MP 55 to MP 75)	In the vicinity of the former railroad tunnel at Snoqualmie Pass, surface geology has been mapped primarily as Tertiary-age rhyolite (Trh) and sedimentary bedrock (Ts) consisting primarily of shale, siltstone, sandstone, and conglomerate (atlas pages 24 and 25). Rocks have been folded at right angles to pipeline corridor, with the crest of a broad anticline between Surveyors Lake and Hyak Lake. Between eastern tunnel portal (atlas page 25) and Stampede Pump Station (atlas page 28), pipeline corridor is underlain primarily by alpine glacial deposits (Qag) and Tertiary bedrock units including rhyolite (Trh), sedimentary rock (Ts), volcanics (Tv), and tuff and breccia (Ttu).

Table 3.2-1. Continued

Pipeline Segment and Mileposts*	Description
	The segment between Stampede Pump Station and Lake Easton (atlas page 32) is underlain by Quaternary alluvium (Qa), glacial till (Qgt), and alpine glacial deposits (Qag) within Yakima Valley bottom, and Tertiary bedrock along valley walls consisting of rhyolite (Trh), volcanics (Tv), and Naches Formation volcanic and sedimentary strata (Tn). This section would also cross the toe of an avalanche runout zone (Avl) and through the toe of a dormant landslide (Qls).
Yakima River to Kittitas Terminal MP 102 to MP 119	Topography and geology between Yakima River crossing (atlas page 41) and Kittitas Terminal (atlas page 52) vary widely. At proposed Yakima River crossing, valley bottom is underlain by loose to medium dense alluvium (Qa) (USGS 1983); eastern slope of valley is dominated by a large landslide deposit (Qls). OPL investigated geotechnical conditions at this proposed crossing with three borings and a bathymetric survey of the river. Two borings on the west side of the Yakima River encountered low to moderate density sand and moderately dense silt with low plasticity. Borings closest to river encountered an underlying layer of medium dense to dense, poorly graded gravel. Landslide materials were not identified in samples taken from these borings. Water depth at the crossing was less than 2 m (6.6 feet) (Dames & Moore 1996). East of Yakima River crossing, pipeline corridor would cross moderate slopes underlain by glacial till (Qgt) and shallow Tertiary basalt (Tb). Remainder of this segment to Kittitas Terminal would cross gentle to moderate slopes generally underlain by Quaternary alluvial deposits (Qa and Qoa) and isolated Tertiary basalt exposures (atlas page 47). Alluvial sediments are clay-rich sands and gravels that were deposited in a series of coalesced alluvial fans. In many places, streams that cross this section of pipeline corridor eroded into older alluvial gravels (Tal) of similar depositional style, but which now form higher terraces.
Kittitas Terminal to the Columbia River MP 119 to MP 149	East of Kittitas Terminal, corridor continues across level alluvial fill in the Ellensburg basin, then climbs through dissected basalt flows. This section of pipeline corridor includes a series of alternate routes primarily underlain by Tertiary basalt (Tb) bedrock. Relatively narrow deposits of Quaternary alluvium (Qa) underlie Johnson Canyon and Canyon Creek, and Quaternary fluvial gravel (Qfg) underlies terraces west of Columbia River. Several landslides (Qls) are located in hills just west of Columbia River (atlas pages 61, 62, and 62a). Fill (f) is also present along portions of I-90 and across the mouth of Getty's Cove.
Columbia River Crossing MP 149 to 150	On west side of Columbia River, surficial deposits consist of either fill (f), alluvium (Qa), fluvial gravel (Qfg) or basalt (Tb). All four alternatives for crossing Columbia River have generally the same geologic features in upland areas adjoining the river. Basalt (Tb) or fluvial gravel (Qfg) underlies the alternate approaches on either side of the river. The proposed pipeline corridor passes through a massive landslide deposit (Qls) at MP 145 (atlas page 62a). Within the river channel, alluvial deposits underlying the river channel behind the dam likely include considerably more silt, sand, and clay than those downstream from the dam. Because of ponding effect of the dam, finer grained sediments have accumulated on the streambed behind the dam; scouring and lack of sediment influx have removed finer sediments from streambed below dam.

Table 3.2-1. Continued

Pipeline Segment and Mileposts*	Description
	The Quaternary fluvial gravel, also known as flood gravel (Qfg), consists of Pleistocene deposits (approximately 15,000 to 12,000 years before present) associated with Lake Missoula floods -- catastrophic events that passed through eastern Washington to Columbia River Gorge following episodic breaks of a glacial dam on Clark Fork River in Montana. Remainder of pipeline corridor, from Columbia River to pipeline terminus at Pasco, crosses landforms shaped by these ancient floods.
Columbia River Crossing to Corfu Alternate Route MP 150	Each of the proposed alternate routes would cross Quaternary fluvial gravel (Qfg), Quaternary sand and silt deposits (Qs), and Tertiary basalt (Tb) between Columbia River and Beverly-Burke Pump Station (atlas page 66). East of Beverly-Burke Station, ground surface is a relatively level plane cut by dry washes eroded during Lake Missoula floods. This section of corridor is underlain primarily by bedrock of Tertiary Ringold Formation (Grolier and Bingham 1971) with scattered exposures of Columbia River Basalt (Tb). Ringold Formation (Tre and Trl) in this area is weakly indurated fine, silty sand. Pipeline would parallel State Route 26, crossing primarily basalt (Tb) with only minor occurrences of Ringold Formation and fluvial gravel (Qfg). Immediately east of stream crossing 240 (atlas page 75), basalt is overlain by thick fluvial gravel to end of segment.
Corfu Landslide and Reroute Around Corfu Landslide MP 173 to MP 178	This segment from beginning to end of Corfu alternate route (atlas pages 77 through 80) would bypass Corfu Landslide by following an alignment along State Highway 26 and crossing Lower Crab Creek and several tributaries. Fluvial gravel (Qfg), alluvium (Qa), and basalt (Tb) underlie first 8 km (5 miles) of this alternate route. It would then turn south (atlas page 80) and cross an area underlain by Ringold Formation lacustrine deposits (Trl) before intersecting original pipeline corridor.
Corfu to Wahluke Slope MP 178 to MP 189	East of Corfu Landslide to Wahluke Slope (atlas pages 80 through 82), pipeline corridor would cross through approximately 5.8 km (3.7 miles) of Ringold Formation lacustrine deposits (Trl) along northern flank of Saddle Mountains. Pipeline would then cross deformed basalt (Tb) and Quaternary loess (Ql) deposits at Wahluke Slope (Grolier and Bingham 1971).
Wahluke Slope to the Othello Channel MP 189 to MP 194	From Wahluke Slope to Othello Channel (atlas pages 82 through 86), pipeline corridor would cross relatively level terrace underlain by loess (Ql), fluvial gravel (Qfg), and Quaternary fluvial/lacustrine sand (Qs). At Wahluke Slope, pipeline corridor turns south across plains underlain by loess (Ql) to beyond Othello Pump Station (atlas page 83). Farther south and southeast, pipeline corridor crosses fluvial/ lacustrine sand (Qs), Ringold Formation (Tru), and sand and gravel flood deposits derived from Lake Missoula floods (Qfg) (Grolier and Bingham 1971).
Othello Channel MP 194 to MP 203	Pipeline corridor would cross Othello Channel (atlas pages 86 and 90). Channel has a present-day relief of approximately 60 m (197 feet), was eroded during Lake Missoula floods, is reportedly eroded approximately 100 m (328 feet) into underlying basalt bedrock, and extends from north of Othello to Columbia River. Channel is underlain by flood gravels and lacustrine deposits above bedrock surface (Grolier and Bingham 1971).

Table 3.2-1. Continued

Pipeline Segment and Mileposts*	Description
	South of stream crossing 261, pipeline corridor would parallel upper edge of a landslide complex that has developed in Ringold lacustrine deposits (Trl) on steep slope along edge of Othello Channel. After crossing this area, pipeline would drop approximately 60 m (197 feet) in elevation into the channel down a slope underlain by Ringold Formation deposits. At floor of channel (atlas page 87), pipeline would cross relatively level ground underlain by Tertiary basalt (Tb) for approximately the first 5 km (3 miles), followed by alternating deposits of fluvial gravel (Qfg) and fluvial/lacustrine sand (Qs). At eastern wall of channel, pipeline corridor rises back up through deposits of Ringold Formation (atlas page 90).
Othello Channel to Pasco MP 203 to MP 227	Pipeline corridor would continue south and southeast from Othello Channel to terminal at Pasco (atlas pages 90 through 100). Geology throughout this section is characterized primarily by fluvial and lacustrine sand (Qs) with minor deposits of fluvial gravel (Qfg); alluvium (Qa); and lacustrine clay, silt, and fine sand of Ringold Formation (Trl).

Note: See the appropriate maps and geologic units (shown in parentheses) within the map atlas for maps of the geology and topography along the pipeline corridor.

* Mileposts are approximate.

erosion potential include the valley walls adjoining Peoples Creek, Cherry Creek, and the Tolt River. Typically the soils that are most susceptible in these environments are glacial outwash sands. These deposits are susceptible to gullying, particularly where surrounding land use changes modify surface water pathways and volumes.

Along the South Fork Snoqualmie River Valley, the corridor crosses tracts of flat land on the valley floor that are characterized as having high erosion potential. These unconsolidated granular soils are subject to stream erosion during flood events. To the east, where the corridor passes through the Cascade Mountains, it typically either crosses along or borders on relatively steep sideslopes, and crosses many stream valleys. The soils on the sideslopes have either moderate or high erosion potential, and soils on the stream valley slopes and floors have high erosion potential.

East of Ellensburg, the pipeline corridor is underlain by soils that are generally finer grained and subject to both wind and water erosion, depending on their location. Much of the upland area along this section of the corridor is underlain by loess deposits that can be easily eroded by wind when the vegetation is removed or disrupted. These soils are also subject to severe gullying where surface water can be channeled over them. The Soil Survey of Grant County indicates that the loess soil mantling the east end of Saddle Mountain is susceptible to such erosion. The ASC map atlas also identifies coarser soils in this area that have high erosion potential, primarily where they mantle or comprise relatively steep slopes. For example, deep gullies were observed in the relatively weakly consolidated soils of the Ringold Formation on the east edge of the Othello Channel.

Mass Wasting. Mass wasting (slide movement) is an ongoing geologic process along portions of the pipeline corridor. Table 3.2-2 provides an inventory of 47 instances of mass wasting along the pipeline corridor -- 23 west of the crest of the Cascades and 24 east of the crest. The mass wasting features listed in this inventory include steep slope areas, areas identified on geologic maps as landslides, landslide features visible on aerial photographs, and areas of mass wasting that were identified during aerial or ground reconnaissance. These mass wasting features include slumps, debris avalanches, debris flows, and snow avalanches. Some are deep-seated and others are shallow; for this discussion, a shallow slide is defined as less than 3 m (10 feet) deep, and a deep-seated slide is one in which the slide plane is greater than 3 m (10 feet) below the ground surface.

OPL evaluated the mass wasting sites identified in the inventory to determine their orientations relative to the proposed pipeline, to assess their potential to incur deep or shallow movement, and to evaluate means of mitigating the landslide potential through avoidance, monitoring, and engineering remedial measures. Field evaluations included aerial and ground reconnaissance, hand auger borings at seven of the sites to evaluate the near-surface soils, and soil borings using a drill rig at nine other sites to evaluate deeper subsurface conditions. The results of these explorations are summarized in Table 3.2-2. Additional subsurface exploration deemed necessary for design and construction is discussed in the "Additional Proposed Mitigation Measures" at the end of this section.

Table 3.2-2. Mass Wasting Inventory

Atlas page	Stream crossing	Slope height (feet)	Slope angle	Pipeline orientation to slope			Geologic Unit[c]	Field visit	Field Investigation	Existing Landslides		
				Perpendicular	Parallel	Position on Slope				Dormant Deep	Active Shallow[a]	Active Deep[b]
4	E of 9	100	3H:1V	x			Qgt	yes	soil boring			
5	W of 11	200	5H:1V	x			Qgt/Qtb/ Qpg	yes	shovel & visual			
5	12&13	150	2.5H:1V	x			Qgo	yes	soil boring			
6	14&15	200	2.5H:1V	x			Qgt/Tan	yes	soil boring		x	
8	20	100	3.5H:1V	x			Qgt	yes	soil boring		x	x
8	21	100	3H:1V	x			Qgo	yes	area visual			
11	NW of 26	200	5H:1V	x			Qgo/Qpf	yes	shovel & visual			
11	SW of 27	300	3H:1V	x			Qls	yes	visual			x
12	N of 28	150	3H:1V	x			Qpf/Qgo	yes	soil boring			
12	S of 28	300	3H:1V	x			Qpf/Qgo	yes	soil boring			
14	37	100	8H:1V		x	near toe	Qpf	yes	soil boring			
17	N of 44	150	2.5H:1V		x	mid-height	Qgt	yes	soil boring			
17	S of 44	100	2H:1V	x			Qgi	yes				
18	46 to 49[d]	600	2H:1V		x	mid-height	Tv/Qgo	yes	visual			
18	45&46[d]	150	1.5H:1V		x	mid-height	Tg/Qgo	yes	visual			
19	50 to 56	<600	2H:1V		x	toe	Tg/Qgo	yes	shovel & visual			
20	59 to 61[e]	700	2H:1V		x	lower	Tg/Qls	yes	shovel & visual	x		
21	63[e]	>400	2.5H:1V		x	lower	Qa	yes	visual			
21	67[e]	>400	2.5H:1V		x	lower	Qa	yes	visual			
21	68[e]	<500	2H:1V		x	lower	Qgo	yes	visual			
23	W of 78[e]	>500	2.5H:1V		x	toe/lower	Tg/Qa	yes	hand auger			
23	E of 78[e]	>500	2H:1V		x	lower	Tg/Qa	yes	aerial			
24	E of 83	>500	2H:1V		x	lower	Ts	yes	aerial			
25	N of 85[e]	300	1.75H:1 V		x	toe	Ts/talus	yes	aerial			
26	92 to 93[e]	<600	3H:1V		x	toe	Ttu/Tv/Avl	yes	aerial			
26	N of 94[e]	<500	2H:1V		x	toe	Ttu	yes	aerial			
30	114	<300	3H:1V		x	toe	Tn/Trh/Qls	yes	aerial	x	x	
31	W of 115	200	3H:1V		x	toe	Qls	yes	aerial & visual	x		
37	E of 134	<200	6H:1V		x	lower	Qf/Qls	yes	hand auger	x		
38	W of 135	>200	5H:1V		x	lower	Qls	yes	hand auger	x		
41	W of 145	250	3H:1V		x	toe	Qls	yes	hand auger	x		
41	W of 147	200	3.5H:1V	x			Qls	yes	soil boring	x		
42	147&148	200	7H:1V	x			Qls	yes	hand auger	x		
42	E of 148	800	2H:1V	x			Tb	yes	aerial & visual		x	
43	W of 151	550	2.5H:1V	x			Tb/Qls	yes	aerial	x		
43	E of 152	650	3H:1V	x			Tb	yes	aerial			
43	152-153	200	3.5H:1V	x			Tb	yes	aerial			
44	E of 156	100	3H:1V	x			Tal	yes	hand auger			

Continued

Table 3.2-2. Mass Wasting Inventory

Atlas page	Stream crossing	Slope height (feet)	Slope angle	Pipeline orientation to slope			Geologic Unit[c]	Field visit	Field Investigation	Existing Landslides		
				Perpendicular	Parallel	Position on Slope				Dormant Deep	Active Shallow[a]	Active Deep[b]
45	157	100	3H:1V	x			Tal	yes	hand auger			
61a/ 62a	Alt 14	500	5.5H:1V		x	toe	Qls	yes	aerial	x		
82	255[f]	>100	5.5H:1V		x	lower	Tb	yes	aerial			
The following Mass Wasting locations were found on alternative pipeline routes and are not located within the proposed route.												
61	9a	100	10H:1V	x			Qls/Tb	yes	aerial	x		
61	Alt 3	300	7.5H:1V		x	head	Qls/Tb	yes	aerial	x		
61	Alt 13	350	4.5H:1V		x	head	Qls/Tb	yes	aerial	x		
62/62a	Alt 13	550	8H:1V	x			Qls	yes	aerial	x		
62a	16b-16g	300	7.5H:1V		x	mid-height	Qfg	yes	aerial			
62b	N of 16a	400	3H:1V		x	mid-height	Qfg	yes	aerial			
63a	SE of 24e	400	5H:1V	x			Qfg/Tb	yes	aerial			
78a/79	E of 246	>300	2.5H:1V		x	toe	Qls	yes	aerial	x		
80a	250-251	>300	6H:1V		x	mid-height	Ql/Tri	yes	aerial			
86 & 87	S of 261[f]	>100	3H:1V		x	upper	Qls/Qfg/Tb	yes	aerial		x	x

Source: Based on OPL 1998.

[a] less than 10 feet deep
[b] greater than 10 feet deep
[c] see geologic and hazard map legend for geologic unit definitions
[d] occurs on federal lands administered by the U.S. Bureau of Land Management
[e] occurs on federal lands administered by the U.S. Forest Service
[f] occurs on federal lands administered by the U.S. Bureau of Reclamation
aerial - visual aerial survey via helicopter

Five of the landslides identified in the inventory are specifically addressed here because they are considered to be more important than others with respect to the safety of the pipeline:

- Peoples Creek and Cherry Creek stream crossings,
- an active landslide on the southeast slope of the Tolt River Valley,
- the slopes on either side of the Yakima River Valley, and
- the slope west of the proposed Columbia River crossing.

These landslides are discussed in the following sections. The large Corfu Landslide was avoided by routing the centerline 1,200 to 2,800 m (3,937 to 9,186 feet) north of the toe of the landslide. BMPs and mitigation measures are included to address all other areas.

Peoples Creek Landslide. At Peoples Creek (stream crossing 15), the pipeline corridor would cross at right angles to the ground contours. The ravine is incised about 18 to 21 m (59 to 69 feet) into the surrounding plateau. The lower 10 m (30 feet) of the slope is underlain by

weathered andesite, and the upper portion of the slope is glacial soil. Near-surface soil on the steeper, lower slope is raveling and slumping into the creek from both banks.

Cherry Creek Landslide. At Cherry Creek (stream crossing 20), the slopes on the north side of the creek are moderate and stable; however, the slopes on the south side are steep and unstable. There are multiple active slides along about 300 m (985 feet) of creek bank. The slope instability appears to be related to surface water and groundwater seepage, in combination with steep slopes and weak glacial soils. Some of the sliding is obviously shallow; however, one of the slides appears to be much deeper and related to groundwater pressure deeper within the slope. Much of the slide debris has landed in the creek or on the narrow terrace adjacent to the creek.

Tolt River Valley Landslide. A large, active, deep-seated landslide is located on the southeast slope of the Tolt River Valley where the pipeline would cross the river (stream crossings 26 and 27). This landslide is about 0.8 km (0.5 mile) wide and ranges in elevation from 46 m (151 feet) at the toe along the river to about 183 m (600 feet) at the top of the headscarp. This slide has probably been active for thousands of years. Although no fresh features were observed on the body of the slide mass, the scarps were not rounded and subtle, indicating probable periodic movement. Movement of the soil is likely to be coincident with high groundwater levels and seismic shaking. The body of the slide has not been explored with deep borings yet; however, based on the size, configuration, and large scale of the slide mass, the base of the sliding plane is most likely very deep.

Yakima River Valley Landslide. The east and west slopes of the Yakima River Valley at the pipeline crossing (stream crossing 147) are mapped as landslides; however, reconnaissance and drilling did not indicate that the slides are active. Nevertheless, these dormant slides could potentially be activated by seismic activity and/or high groundwater pressure. Based on the size of these features, it is apparent that they are deep-seated.

Columbia River Crossing Landslides. Just west of the proposed Columbia River crossings is a group of several landslides. The largest of these slides, which is located south of Vantage, is over 2 km (1.2 miles) wide. It has a high but rounded headscarp and rounded hummocky topography at the toe of the slope, both indicative of a dormant landslide. The proposed pipeline corridor traverses through the middle of this landslide mass, parallel to the topographic contours. Some of the land on the headscarp is bare, indicating active erosion. The second largest slide is north of I-90, on a slope that overlooks the freeway and is immediately south and downslope from the proposed pipeline. This feature also appears to be dormant, not having sharp or fresh scarps.

3.2.1.3 Topography

In the Puget Lowland at the west end of the pipeline corridor, the relatively low and level glacial fill has been dissected by post-glacial streams, which have steep side slopes. In general, the ground surface elevations range between 90 and 150 m (295 and 492 feet); however, east of the Snoqualmie River mainstem valley, the corridor reaches elevations of about 300 m (985 feet). The pipeline corridor then drops down and penetrates into the central Cascade Range along the south edge of the U-shaped valley of the Snoqualmie River, rising slowly, nearly to the crest of Snoqualmie Pass at about 760 m (2,493 feet) elevation. Along the valley, the corridor would traverse many creeks and rivers that flow into the valley from the south.

The corridor then continues eastward through the central Cascades, following the south side of the U-shaped Yakima River Valley. The topography along this part of the pipeline corridor is not particularly steep, but the mountain slopes to the south are somewhat precipitous. The pipeline corridor then emerges into the Ellensburg Basin, a combination of basalt-based level ridges with steep sidewalls and broad coalesced alluvial fans. The basin is a relatively flat featureless plain east of Ellensburg, until it rises through Johnson Canyon and into the dissected Ryegrass Mountains. Just west of the Columbia River the ground surface along the pipeline corridor drops about 120 m (394 feet) into the Columbia River Gorge. This wide gorge would be crossed at about elevation 150 m (492 feet).

East of the Columbia River Gorge, the corridor crosses level ground at an elevation of about 335 to 366 m (1,100 to 1,200 feet); this area is periodically cut by dry washes. Where the pipeline corridor bends to the southeast, it crosses lower Crab Creek, before rising again to pass over the east end of the Saddle Mountains. At the east end of this ridge, the corridor gains about 90 m (295 feet) in elevation above lower Crab Creek before dropping down again to the south to a broad terrace (Wahluke Slope). Descending the east slope of the terrace, the pipeline then crosses the Othello and Esquatzel Channels, which are remnants of erosion by the late-Pleistocene Lake Missoula floods. The elevation ranges from about 228 to 275 m (750 to 900 feet) across this scoured topography. The elevation of the ground surface at the south terminus of the pipeline corridor is approximately 122 m (400 feet).

3.2.1.4 Unique Physical Features

There are three unique physical features within or near the pipeline corridor: the Corfu Landslide, the Snoqualmie Tunnel, and Ginkgo Petrified Forest State Park.

Corfu Landslide. The Corfu Landslide, near the townsite of Corfu at the base of the north slope of the Saddle Mountains, covers more than 10 km^2 (4 square miles), and is one of the largest

landslides in the state. Contributing factors to the slide are the presence of two faults that run through the slide body, and the undercutting of the toe of the slope by the waters of the late-Pleistocene Lake Missoula floods. Based on topography, it is likely that the slide mass is not presently moving, but has moved episodically in the past. The soil within the slide mass is highly disturbed and has a strength much lower than the surrounding rock. The Corfu Landslide was avoided by routing the centerline of the pipeline north of the toe of the landslide.

Snoqualmie Tunnel. The Snoqualmie Tunnel was constructed between 1913 and 1915 by the CMSP&P Railroad and was in continuous service as a railroad tunnel into the 1970s. It was out of use until recently when it was opened to pedestrian, equestrian, and non-motorized vehicle use.

The tunnel is approximately 3,627 m (11,900 feet) long and is mostly straight except for curves at the portals. The tunnel profile is a modified horseshoe shape with near-vertical sidewalls and a radius arch. It is entirely lined with reinforced concrete including concrete portal structures and headwalls at both portals. The tunnel has not been continuously maintained since the 1970s; however, the invert was graded and portions of the wooden drainage channel covers were replaced before it was reopened for recreational use.

Dames & Moore personnel performed a site reconnaissance of the tunnel on July 30, 1997. They observed zones of concrete deterioration, seepage from construction joints, and cracks in the lining. Groundwater flows ranged from drips to flows through the lining ranging from 3.8 to 7.6 liters (1 to 2 gallons) per minute. The concrete lining varied in condition from intact to spalled and decomposed as much as 0.3 m (1 foot) behind the original finished face of the concrete. Reinforcing steel was exposed in some of the deeper spalled areas. The pipeline would be buried in the floor throughout the length of the tunnel.

Ginkgo Petrified Forest State Park. The pipeline corridor would pass through Ginkgo Petrified Forest State Park from its western boundary toward Vantage leaving the park at its southern boundary south of Wanapum Campground. This park is listed on the National Natural Landmark Registry and has been listed by the National Park Service as a National Natural Endangered Resource. It includes an interpretive center and museum, interpretive and hiking trails, campgrounds, and facilities for swimming and boating. It is a showcase for approximately 200 species of fossilized wood and leaf material that are exposed in the bedrock and found lying on the ground surface in this area. The fossilized plant material, which originated in an environment of swamps and lakes in Miocene time (approximately 15 million years ago), is found within the upper part of the Vantage Sandstone and at the base of the overlying basalt flow. The plant fossils, which occur both within the sandstone and basalt beds and weathered out on the ground surface, are exceptionally well preserved in this locale because they were rapidly buried by lava and petrified.

3.2.1.5 Faults, Seismicity, and Liquefaction

Faults. Although the Pacific Northwest is tectonically and seismically active, relatively few young surface faults have been identified in the region, partially because seismic events large enough to propagate fault ruptures to the surface are infrequent. In the Puget Sound area, this also may be partially a function of the ability of the relatively thick unconsolidated sediments to take up the strain of deep-seated fault movement without a noticeable surface manifestation.

Section 2.15 and the Appendix A map atlas of the ASC show known and suspected faults of all ages along the pipeline corridor, as well as active and Quaternary faults within about 48 km (30 miles) of the pipeline corridor. Of these features, only active faults (those showing evidence of movement during the last 10,000 years) are considered to have a reasonable potential to rupture the ground surface during the life of the project. Faults with evidence of Quaternary movement (during the last 1.6 million years) are generally of less concern, but have the potential to generate strong ground motions of potential engineering significance within the pipeline corridor, particularly where they are spatially associated with historic seismicity. Faults that show no evidence of movement in Quaternary time are generally not considered to pose a risk of seismic potential over the life of engineered projects.

The pipeline corridor would cross several pre-Quaternary faults, mostly in the Cascade Mountains and in the vicinity of Ellensburg. However, it would not cross the mapped surface trace of any known active faults or faults with known Quaternary movement. The Seattle and Whidbey Island faults are potentially the most important active faults west of the Cascades. These faults have not generated earthquakes greater than magnitude (M) 6 historically, although the Seattle fault last ruptured the ground surface approximately 1,100 years ago during an earthquake estimated to be M 7-7.25 (Bucknam et al. 1992, Johnson and Potter 1994). The mapped trace of the Seattle fault extends from Bainbridge Island to the vicinity of Issaquah, approximately 12 km (7.5 miles) west of the pipeline corridor near Snoqualmie.

East of the Cascades, the closest Quaternary fault to the pipeline corridor is the Saddle Mountains fault. This fault has documented displacement of late Quaternary-age deposits, and probably had surface rupture associated with a large earthquake within Holocene deposits on the Smyrna Bench west of the Corfu Landslide (West et al. 1996). As mapped, the easternmost extent of this fault terminates approximately 2.4 km (1.5 miles) from the nearest segment of the pipeline corridor. However, the pipeline corridor may cross the buried eastern extension of the Saddle Mountains fault, which is inferred to be present beneath the Corfu Landslide deposits and the Quaternary loess and alluvial deposits east of the landslide. This fault is located in one of the most seismically active areas in the eastern half of the state (Geomatrix Consultants 1990, 1993).

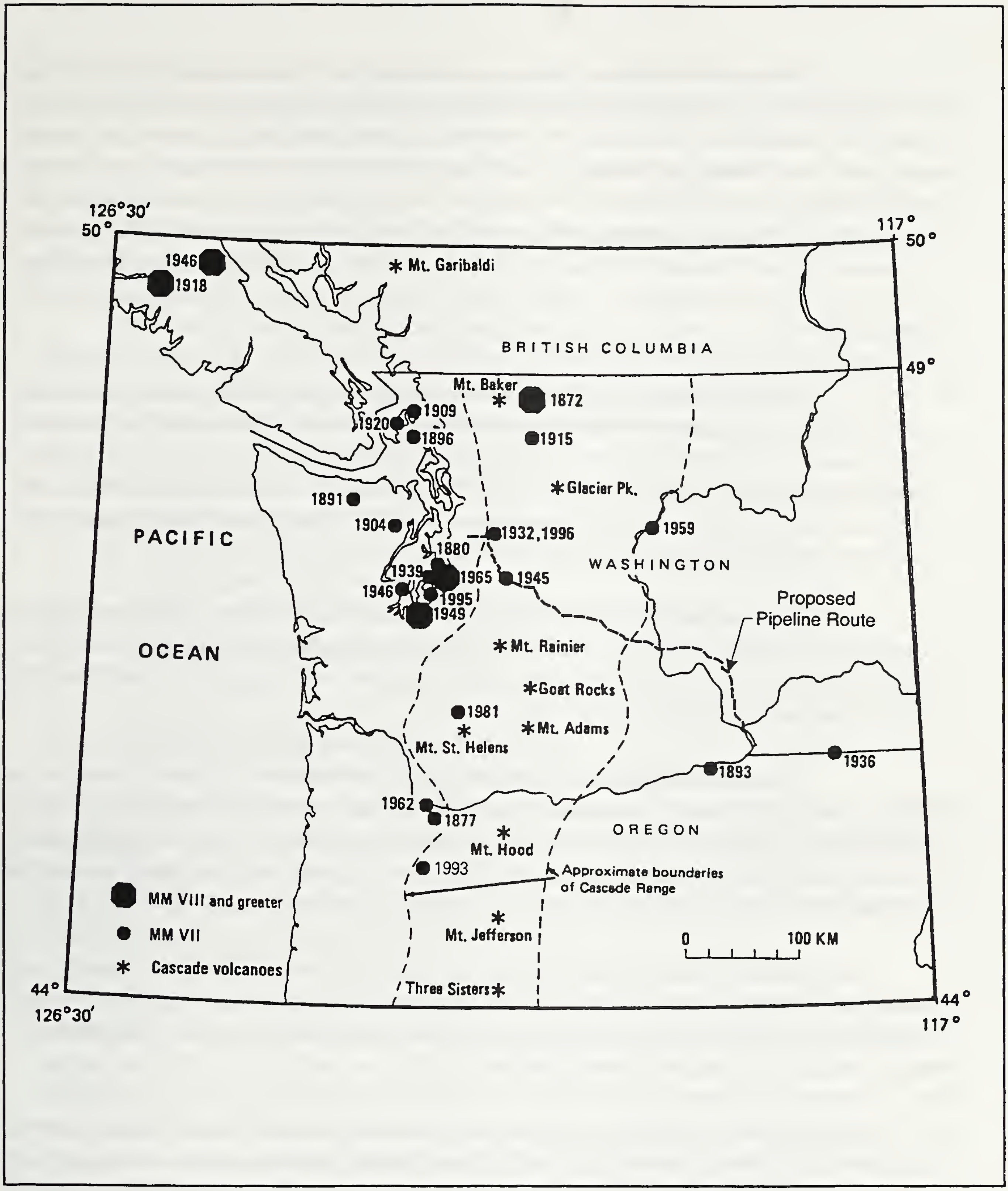
The potential for surface rupture on other Quaternary faults within the region does not pose a recognizable hazard to the pipeline. However, several of these shallow crustal faults have the potential to generate strong ground motions of engineering significance within the pipeline corridor. Several of these Quaternary faults are spatially associated with earthquake epicenters of historical, instrumentally recorded events, but there has been no documented historical surface fault rupture on any of these faults. Similarly, there have been no historical, instrumentally recorded earthquakes of greater than M 5.0 associated with these faults, with the possible exception of the 1936 M 6.1 Milton-Freewater earthquake. This earthquake may have been associated with the Wallula fault zone, which exhibits displacements of Holocene deposits (less than about 10,000 years old) (Mann and Meyer 1993). This fault zone is located approximately 14 km (8.7 miles) south of the pipeline terminus at Pasco.

Seismicity. The locations of historical earthquakes in Washington and northern Oregon of potential engineering significance to the proposal are presented on Figure 3.2-1. Based on historical earthquakes and geologic studies of prehistoric earthquakes, an assessment of the likely severity of future earthquakes that could affect the pipeline corridor can be made.

Earthquakes are the result of sudden releases of built-up stress within or between the tectonic plates that make up the earth's surface. The stresses accumulate because of friction between the plates as they attempt to move past one another. For this proposal, three general sources of seismic activity are of potential engineering significance: (1) interplate earthquakes along the Cascadia Subduction Zone; (2) earthquakes originating within the Juan de Fuca plate; and (3) earthquakes originating in the shallow crust.

Cascadia Subduction Zone. The Cascadia Subduction Zone (CSZ) is the origin of the largest and most infrequent earthquakes in the region. The CSZ lies about 100 to 175 km (62 to 109 miles) west of the Washington coastline and marks the boundary between converging tectonic plates. Major earthquakes are believed to occur along this zone every several hundred years.

The CSZ has had little instrumentally recorded seismic activity in western Washington. A review of the existing literature suggests that an M 8.5 earthquake is a reasonable estimate of the largest event that could occur on this zone, and can be considered to be the maximum credible earthquake for this region (Atwater et al. 1995). This type of event would generate ground motions for a relatively long duration in the western portion of the pipeline corridor. Geologic evidence indicates that such an event last occurred approximately 300 years ago.



EPICENTERS AND DATES OF
LARGER PACIFIC NORTHWEST EARTHQUAKES

Source: Modified after Washington State
Department of Natural Resources and EERI

Cross Cascade Pipeline
Washington
FIGURE 3.2-1

Juan de Fuca Plate. The second seismic source originates beneath the continental plate within the subducted Juan de Fuca plate. This source has generated two of the largest historical seismic events in the Pacific Northwest: the 1949 Olympia earthquake (M 7.1) and the 1965 Seattle earthquake (M 6.5). Intraplate seismic events are geographically more widespread and result from various structural sources in the crust. These types of earthquakes have historically caused the greatest amount of damage in the Puget Sound region. Based primarily on the historical seismicity of intraplate origin in western Washington, such as the 1949 M 7.1 Olympia event, and other subduction zones of the world, the intraplate zone is considered capable of generating earthquakes as large as M 7.5.

Shallow Crust. The third type of earthquakes originates in the shallow crust. Only one of this type of earthquake of magnitude greater than M 6 has occurred historically in the region of the proposal: the 1872 earthquake in north-central Washington. However, there is geologic evidence that a shallow earthquake of M 7.0 to M 7.25 occurred on the Seattle fault approximately 1,100 years ago (Bucknam et al. 1992, Johnson and Potter 1994), and the 1996 M 5.3 earthquake occurred at a depth of approximately 7 km (4.3 miles).

One of the most seismically active regions of the state with respect to shallow earthquakes is the Yakima Fold Belt (Geomatrix Consultants 1993). The largest instrumented earthquakes of the Columbia area were M 5.0 events in 1918 at Corfu, and at the Royal Slope of the Frenchman Hills in 1973 (Geomatrix Consultants 1990, 1996).

Potential Seismic Activity along Entire Pipeline Corridor. Based on the historic seismicity and tectonic considerations, the estimated peak ground acceleration levels derived by Frankel et al. (1996) are shown for the entire proposal area in the ASC. These levels are based on the peak ground accelerations that are considered to have a 10 percent chance of being exceeded in a 50-year period, which correlates roughly to a 500-year return period.

The estimated ground motion decreases from a maximum value of 0.29g at the western end of the pipeline (Thrasher Pump Station) to a minimum of 0.08g near the eastern terminus in Pasco. These levels of ground shaking could trigger landsliding; damage inadequately designed above-ground structures; or cause liquefaction of soils.

Liquefaction. Liquefaction is a phenomenon in which loose to medium dense, saturated, granular soils lose their shear strength during dynamic loading (usually during an earthquake) and behave as a fluid. Liquefaction causes soil settlement, and can result in lateral spreading or slope failure of a soil mass. Loose sandy soils saturated by shallow groundwater are the most susceptible to liquefaction. Clayey or cemented soils, which derive most of their strength from interparticle forces, are less susceptible to liquefaction. Similarly, non-saturated soils, regardless of composition or cementation, are not susceptible to liquefaction.

A preliminary evaluation of liquefaction potential is presented in the ASC (OPL 1998). The areas where surficial geologic materials are not susceptible to liquefaction (clay and rock) and those areas where near-surface groundwater (e.g., groundwater greater than 12 m [40 feet] below ground surface) is not known to be present were considered not susceptible to liquefaction. The remaining areas, predominantly young alluvial deposits in low-lying drainages and river and stream channels, were identified as having the potential for liquefaction. These areas are shown in the map atlas of the ASC and are listed in Table 3.2-3.

Areas along the pipeline corridor that have potential for liquefaction are underlain by alluvial sediments and are located in the larger stream valleys. These areas have the potential for liquefaction due to the presence of relatively loose granular soil and shallow groundwater. Based on OPL studies to date, the areas that have the greatest potential for liquefaction include:

- Snoqualmie River Valley (MP 8 to 9);
- Cherry Creek Valley (MP 17);
- Tolt River Valley (MP 23/24);
- Griffin Creek Valley (MP 26);
- Snoqualmie River Valley between Snoqualmie and North Bend; and
- Tillman Creek Valley near Cle Elum.

3.2.1.6 Stream Scouring and Lateral Migration

The potential for stream erosion by bed scouring and lateral channel migration is an important consideration in designing watercourse crossings for petroleum pipelines because these processes can expose a buried pipe to the hydraulic and abrasive forces of water flow, as well as sediment and debris movement. Both scouring and lateral migration occur primarily during flooding when streamflow forces are sufficient to erode bank and bed material.

Scour is the lowering of a streambed, which can occur naturally, typically in response to passage of a flood. It is most often caused by a change in stream hydraulics in response to a restriction or impingement of flow, or a deflection of floodflows. Changes can be induced by human manipulation of a stream, formation of log jams or ice jams, mass wasting of streambanks, or rapid influx of sediment and debris into the stream from mudflows or erosion associated with large storm events. Scour can also occur as relatively steady, progressive erosion as a stream gradually erodes toward its headwaters.

Table 3.2-3. Liquefaction Susceptibility

Liquefaction Zone	Map Atlas Page No.	Location	Length of Affected Pipe (m)	Ground or Aerial Reconnaissance	Field Investigation Performed	Liquefaction* Susceptibility	Lateral Spread/ Settlement Potential
1	5	Snoqualmie River Valley	1,676	Yes	Yes	4	Yes
2	8	No. Fk. Cherry Creek	305	Yes	No	2	No
3	11	Tolt River	488	Yes	No	NA	No
4	12	Griffin Creek	122	Yes	No	NA	No
5	14-16	Snoqualmie Valley	9,327	Yes	Yes	3	No
6	31	Cabin Creek	732	Yes	No	1	No
7	37	Tillman Creek	183	Yes	No	2	No
8	43	Swauk Creek	183	Yes	No Access	1	No
9	44	W. Fk. Dry Creek	274	Yes	No	1	No
10	45	E. Fk. Dry Creek	91	Yes	No	1	No
11	46-47	Reecer/Jones Creek alluvial fans	3,810	Yes	No	1	No
12	47	Currier Creek tributary	152	Yes	No	1	No
13	47-48	Currier Creek tributary	975	Yes	No	1	No
14	48	Currier Creek	152	Yes	No	1	No
15	53	Parke Creek	457	Yes	Yes	1	No
16 17	55	Parke Creek/Johnson Canyon	Primary 732 Alternate 2,774	Yes	Yes	1	No
18	78	Lower Crab Creek tributary	457	Yes	No Access	1	No
19	78	Lower Crab Creek tributary	305	Yes	No Access	1	No
20	79	Lower Crab Creek tributary	610	Yes	Yes	1	No
21	79	So. of Othello Pump Station	457	Yes	No	1	Yes
22	83-84	So. of Othello Pump Station	2,682	Yes	Yes	1	No

Table 3.2-3. Continued

Liquefaction Zone	Map Atlas Page No.	Location	Length of Affected Pipe (m)	Ground or Aerial Reconnaissance	Field Investigation Performed	Liquefaction* Susceptibility	Lateral Spread/ Settlement Potential
23	84-85	W. of Othello Channel	2,560	Yes	Yes	1	No
24	86	Othello Channel	No intersect	Yes	No Access	1	No
25	88-89	Othello Channel	2,438	Yes	Yes	1	No
26	89-90	Othello Channel	1,554	Yes	Yes	1	No
27	91-92	Othello Channel to Esquatzel Coulee	4,572	Yes	Yes	1	No
28	93-96	Othello Channel to Esquatzel Coulee	10,668	Yes	Yes	1	No
29	96-100	Esquatzel Coulee to Pasco	12,192	Yes	Yes	1	No

*Key:
1. Predominantly non-liquefiable with potential for isolated pockets of loose granular soil
2. Typically non-liquefiable with potential for lenses of liquefiable sand and non-plastic silt
3. Predominantly liquefiable with potential for lenses of non-liquefiable clay
4. Liquefiable throughout the deposit

NA - No information available

Source: Based on OPL's Application for Site Certification and additional information provided by Dames & Moore.

Lateral migration of stream channels is also a natural ongoing process, particularly on the outside of bends in alluvial rivers where a stream's erosive power is typically greatest. However, either natural or human-made changes in stream geometry, blockage of flow, or increases in flow intensity can accelerate it. As with scouring, rapid changes in stream channel location can result from mass wasting of streambanks, formation of log jams, and mudflows.

Many of the larger streams that occupy channels within broad floodplains have the potential for substantial lateral bank erosion and channel relocation, as well as the potential for localized scouring of their beds. In the pipeline corridor, these types of streams include the Tolt River, Snoqualmie River, Little Creek, Cabin Creek, Big Creek, Yakima River, Swauk Creek, and Coleman Creek.

In the case of Cabin Creek, the floodplain has been artificially confined to less than 10 percent of its natural width by two bridge spans directly upstream of the pipeline crossing. This confinement, combined with periodic rapid discharges resulting from upstream landslide blockage and subsequent blowouts, has resulted in localized channel scouring and undermining of bridge abatements. This scouring could expose the pipeline if it is not placed below the maximum scour depth.

The smaller, steep-gradient streams in the mountainous areas tend to occupy deep ravines that confine their lateral migration. Where these stream channels are incised in competent bedrock, there is little potential for rapid erosion. However, where they occupy channels underlain by alluvial fill, many of these smaller streams could have significant scour potential. This is especially true in the Cascades, where many of the mountain streams are subjected to mudflows, torrential melt-water floods, and storm runoff capable of transporting large volumes of coarse sediment and debris.

3.2.2 Environmental Consequences

3.2.2.1 Proposed Petroleum Product Pipeline

Construction Impacts - Overall Proposal. Construction of the pipeline could have impacts on the environment by triggering mass wasting and soil erosion, disrupting streams as a result of directional drilling or trenching, disrupting fossils at Ginkgo State Park, or resulting in hazards to workers during construction in the Snoqualmie Tunnel. Potential construction impacts and measures that would be implemented to reduce them are discussed below.

Mass Wasting. Mass wasting could occur during construction as a result of one or more of the following: (1) undermining the toe of a steep slope or existing landslide area could trigger mass wasting which could then release fine-grained soil into adjacent water bodies; (2) soils

placed near the top of an existing landslide or unstable slope could cause slope movements which could release fine-grained soils into nearby water bodies; and (3) soils stockpiled on steep slopes could fail or erode, running into water bodies nearby. Such events would have a temporary but minor to moderate impact on water bodies, depending on the volume of soil that was released, and the time of the year that it occurred.

The potential for undermining of a slope could be reduced by performing detailed reconnaissance just prior to construction in steeply sloping areas where the trench excavation would be parallel to topographic contours and at the toe of the slope, by maintaining geotechnically trained personnel onsite during construction in those areas, and by backfilling all steeply sloping portions of the trench on the same day as the excavation of the trench.

Overloading the top of a slope could be avoided by carefully planning stockpile and refuse areas. Such areas would be evaluated by a geotechnical expert to preclude the use of marginally stable or unstable slopes.

To prevent soil stockpiles from failing or being eroded, BMPs for erosion control would be applied (see Appendix C), and the stockpiles monitored for compliance, particularly in areas that have soils that are highly erodible when disturbed.

Implementation of the above measures during construction would greatly reduce the potential for mass wasting during construction, and would reduce the volume of any mass wasting that would occur. The resultant impact would be expected to be negligible to minor if adverse conditions are properly identified and mitigated.

Erosion. During construction, erosion could result from disturbance of soil by trench excavation, road building, and borrow operations. Fine soil particles entering a water body may affect plants and animals. The impacts from such erosion would range from negligible to moderate depending on the volume of sediment released and the time of year when it occurred.

Measures to control erosion during construction would concentrate on those areas adjacent to water bodies and/or steep slopes, and would include BMPs for scheduling (time of year), sequencing of construction activities, minimization of areas to be disturbed, diversion of surface runoff, sediment trapping, minimization of soil exposure, reduction of surface water velocity, timely revegetation, and frequent inspection of the work by qualified specialists. Properly implemented, these measures should result in only negligible impacts from erosion during construction.

Hazards in Snoqualmie Tunnel. In the Snoqualmie Tunnel, concrete and rock falls could occur in sections of the tunnel that are deteriorated, endangering the lives of workers, particularly when they are creating vibrations in proximity to these sensitive areas. The severity of

such an event is not in its impact to the environment, but in the safety hazard it could pose to workers. If vibrations from rock excavation and blasting were to loosen deteriorating concrete, the construction could also increase the potential for future spalling, thus posing a somewhat greater hazard to future users.

The potential for concrete or rock fall in the Snoqualmie Tunnel could be reduced by placing an underlay lining of reinforced concrete or shotcrete in the more deteriorated or cracked sections of the tunnel. Where appropriate, rock dowels could be installed to support specific blocks of cracked concrete located in the crown or sidewalls. The need for such remedial measures would be carefully evaluated prior to initiation of construction. Proper design and implementation of remedial work in the tunnel would result in much safer working conditions in the tunnel.

Disruption of Ginkgo Petrified Forest State Park Fossils. Localized disruption of a nationally significant assemblage of fossilized forest remains could result from construction of the pipeline corridor through Ginkgo Petrified Forest State Park. Fossil beds are exposed at or near the ground surface, whereas other areas have petrified wood lying on the ground. The fossil beds and pieces of petrified wood on the ground surface would be disturbed by the trench excavation, road construction, and heavy equipment operation. Staging areas and stockpiling of equipment, excavated soils, and fill materials would damage any loose fossils and could also disrupt the fossil beds if they were placed directly on the fossil-bearing rock strata. Although the fossil beds are locally extensive and the footprint of the pipeline construction would be relatively small, this natural resource could not be restored once it was disturbed.

Stream Crossings, Sediments, and Drilling Fluids. Potential environmental impacts associated with construction at stream crossings would vary with the crossing technique that is employed at a given stream. Trenching within streambeds could significantly increase short-term sediment loading by disrupting the streambed sediments in the trench, by streambank and streambed disruption during construction, and by erosion resulting from improper selection and placement of trench backfill.

Existing bridges would be used to cross streams wherever practical. Elsewhere, BMPs would be followed to minimize the impact of stream trenching operations. These would include BMPs for scheduling (time of year), sequencing of construction activities, minimization of areas to be disturbed, diversion of streamflow, sediment trapping, minimization of bank disruption, timely revegetation, and frequent inspection of the work by qualified specialists. Properly implemented, the application of BMPs would result in negligible to minor impacts to stream channels.

Where minor impacts to water quality and habitat are not acceptable or where excavation methods are impractical, either directional drilling or horizontal directional drilling crossing technologies would be employed. These methods would not directly disturb the streambed or banks,

so they would have considerably less impact than trenching. Nevertheless, where stream crossings would involve directional drilling or horizontal directional drilling, potential impacts during construction would include: (1) release of drilling fluid to the stream through pervious sediments or as a result of hydrofracturing the geologic materials during drilling; (2) loss of drilling fluid due to leakage from mud pits, and (3) failure to provide proper cleanup and disposal of used drilling fluids.

While mitigation measures for these potential impacts would be required for any drilled stream crossing, the potential for impacts is particularly great for crossing the Columbia River by horizontal directional drilling downstream of Wanapum Dam. This crossing would involve a 760 m (2,493-foot) long boring under the river, at a depth of at least 15 m (49 feet) below the riverbed, and of sufficient diameter to accommodate the 30 cm (12-inch) pipeline. Based on limited explorations conducted to date, the soils at this crossing are highly permeable and not very stable, a combination of conditions that has the potential to make the construction of this bore very difficult.

Specifically, horizontal directional drilling in highly permeable, coarse-grained sand, gravel, cobbles, and boulders such as those underlying the Columbia River would be difficult because of the potential for loss of circulation and the instability of the bore. There is a potential for collapse of the hole, which could result in the loss of both the bore and the drilling tools. There is also potential for release of drilling fluids to the river, either as a result of leakage through the permeable stream deposits, or by hydrofracturing the formation in an attempt to free drilling tools from a collapsed boring. Such a release could have an adverse environmental impact on water quality, depending on the volume of the materials entering the river and the time of the year. It could also result in a longer construction schedule and greater disruption of the near-shore environment.

OPL has identified several measures that would be used to reduce the potential impacts resulting from release of drilling fluid to the river, while improving the potential for success of a drilled crossing at the Columbia River (see Appendix C for details). On shore, the drilling fluids would be contained in lined basins. Fluids would not be allowed to discharge from the basins or the surface of the drill site to any stream. Once the drilling is completed, the fluids would either be buried in an excavated pit away from the shoreline or would be removed from the site using vacuum trucks for disposal in an approved landfill or other approved disposal site. Proper implementation of these measures would result in only minor impacts to the stream from the onshore construction activities.

OPL has proposed measures to reduce the potential for leakage of drilling fluids from the horizontal bore into the river during drilling. Specifically, OPL proposes to conduct additional explorations using vertical boreholes to better characterize subsurface conditions along the horizontal bore path. The proposed drill path would provide considerable sedimentary cover over the boring, and high-viscosity drilling mud would be used to minimize infiltration into the sediments. OPL also plans to use only bentonite drilling fluids (no oil) for drilling, and to monitor the drilling fluid pressure and flow rate during drilling to anticipate blowout situations and to monitor fluid loss to the

formation. These measures would reduce the potential for a major leak from the bore into the river. However, the available subsurface data indicate that there would still be a potential for leakage to the river through the pervious soils. More significantly, there is a potential for collapse of the borehole, which might trigger recovery measures that could increase the chances of hydrofracturing the formation or leaking drilling fluids to the river. OPL has also indicated that partial casing of the borehole and grouting and redrilling could be accomplished to improve borehole stability, if necessary.

Construction Impacts - Columbia River Approach Options. Impacts to the geologic environment and ground stability resulting from construction of either of the YTC corridor segment options approaching the Columbia River would be similar to those resulting from construction of the proposed route, with the exception that they would avoid passing through Ginkgo Petrified Forest State Park and through a 2.4 km (1.5-mile) wide landslide to the east of the park. Consequently, disruption of the fossil beds in the park would be eliminated, and the risks of ground instability in the landslide mass could be avoided.

Construction Impacts - Columbia River Crossing Options. In addition to the proposed Columbia River crossing method (horizontally drill a crossing downstream from Wanapum Dam), OPL has identified four alternative Columbia River crossing routes: dredging a crossing north of I-90, attaching the pipeline to the I-90 Bridge at Vantage, attaching the pipeline to the Burlington Northern Beverly Railroad Bridge south of Wanapum Dam, or placing the pipeline on Wanapum Dam. There are also various approach routes to the alternative crossing sites. The horizontal directional drill is OPL's preferred crossing method at this time for the following reasons:

- Whereas the site soil conditions are not optimum for a horizontal directional drill south of Wanapum Dam, OPL has determined that current technology exists to successfully complete the installation with a low probability of fracturing out and releasing drilling fluids to the river.

- The other crossing options include using the I-90 Bridge, Beverly Railroad Bridge, or Wanapum Dam to support the pipeline, or dredging a pipeline trench across the Columbia River north of the I-90 Bridge. The options involving supporting the pipeline on an existing structure would all eliminate geologic impacts that could result from a drilled or dredged crossing. However, since the rights to use these structures have not been secured to date from the appropriate regulatory agencies, these alternatives are potentially unavailable as crossing options.

- OPL has entered discussions with the Washington State Department of Transportation (WSDOT) about the possibility of using the I-90 Bridge; to date WSDOT has not made

a decision about the acceptability of using the bridge. This would be the least expensive of the alternatives and would likely have the fewest environmental impacts.

- Use of the Beverly Railroad Bridge would require obtaining permission from Washington State Parks and Burlington Northern Railroad, who is considering reactivating the bridge for railroad traffic. The potential for future railroad use, the greater length of exposed pipeline, and the unknown but questionable structural integrity of the bridge all reduce the desirability of this option. Without proper rehabilitation of the bridge and abutments, this route might also pose an operational risk of pipeline rupture above the river resulting from damage to the bridge by seismic shaking.

- OPL has also applied to Grant County Public Utility District for a permit to place the pipeline along the upper portion of Wanapum Dam. However, no decision has been made to date as to whether that permit would be approved.

- The other option, which would involve a trenched crossing north of the I-90 Bridge, is considered by OPL to be the least preferred alternative. A wet trench method would be used, which would result in release of sediment into the river and would disturb the shoreline. While this method is feasible, it would require mitigation measures to minimize impacts to fish habitat and shorelines.

The alternate routes for the dredged and I-90 Bridge crossings continue east on the north side of I-90, cross the river, and continue south along the east side of the Columbia River, rejoining the proposed pipeline corridor approximately 2.5 km (4 miles) east of Wanapum Dam. With the exception of the Columbia River and Ryegrass Coulee, streams crossed by these two alternative routes (crossings 24a to 24c) are intermittent and would be crossed when they are dry. Ryegrass Coulee would be a bored crossing.

There are also several alternative approach routes which originate at the YTC segment option north of I-90 and extend to the proposed crossing location (crossing 223) and the Burlington Northern Railroad Bridge crossing. Each of these options crosses similar terrain, where there would be only negligible geologic impacts during construction except where these alternative routes cross the Ginkgo Petrified Forest State Park in the slopes above the Columbia River. Impacts in the park are discussed above, whereas the other impacts in this area are discussed under "Stream Crossings and Landslide Areas - Columbia River" in the operational impacts section below.

Operational Impacts - Overall Proposal. Mass wasting and erosion, landslides, seismic disturbance and liquefaction, and stream scouring or migration could all result in breakage of the pipeline during operation. The resulting impacts would vary in magnitude and type, depending on the location of the break relative to sensitive environments and water resources. The potential risk

of a spill from the pipeline is addressed in Section 3.18, Health and Safety. Potential impacts from such ground movements, and measures that either have been or would be implemented to prevent or minimize those impacts, are described below.

Mass Wasting and Erosion. Potential impacts from mass wasting and erosion include the following:

- Breakage of the pipe as a result of unavoidable subsurface landslide movements.
- Channeling of ground and/or surface water along trenches into a landslide mass or colluvium on steep slopes, resulting in initiation or reactivation of a landslide.
- Breakage of the pipeline by surface mass wasting movements, such as avalanches or mudflows.
- Loss of ground by erosion from beneath the pipe, resulting in breaking the pipeline.
- Failure of trench backfill, particularly on steep slopes.
- Failure of a culvert or bridge footings below the pipeline, resulting in washout of the overlying embankment and pipeline.
- Release of product into an aquifer or an adjacent water body as a result of pipe extension or compression caused by ground movement.

The environmental impacts resulting from such failures could range from minor to major depending on the location where a pipe break occurred with respect to sensitive environments, the timing of the release with respect to the life cycle and presence of sensitive species, and the volume of product that was released. Potential general measures OPL has proposed to minimize mass wasting are described in Appendix C.

Table 3.2-4 indicates the types of specific measures that have been or would be used to address mass wasting hazards at specific sites along the pipeline corridor. Additional site-specific geotechnical investigations would be required to design selected mitigation options. Data collection methods would include subsurface exploration and/or geophysical exploration, followed by detailed slope stability analyses and design of slope stabilization measures. Where possible, the pipeline corridor has already been adjusted to avoid mass wasting features. However, where this was not feasible, other measures would be employed during design and construction such as installation of strain gauges to detect pipe movement, thicker pipe walls, slack loops, and buoyancy compensation. For some locations, remotely operated block valves (shut-off valves) would be an appropriate safety

Table 3.2-4. Mass Wasting Hazard Assessment

Geologic and Hazard Map Page	Stream Crossing or Alternative Route	Hazard Potential		Mitigation Measures								
		Shallow Failure[a]	Deep Failure[b]	Avoidance	Strain gage on pipe	Long Term Monitoring	Drainage	Buttress	Increase Burial Depth	Additional Exploration for Design	Flexible Couplings	Block Valves[f]
4	E of 9	L	L									
5	W of 11	H	L				x		x	x		x
5	12&13	M	M				x	x		x		
6	14&15	H	L				x	x	x	x		
8	20&21	H/H	H/L			x	x	x	x	x		x
11	NW of 26	M*	M*							x		
11	SW of 27	H*	H*		x	x	x			x	x	x
12	N of 28	M	L						x	x		
12	S of 28	M	L						x	x		
14	37	H	M				x	x	x	x	x	
17	N of 44	M	L						x	x	x	
17	S of 44	M	M						x	x		
18	E of 44	M	L						x			
18	45&46[c]	H	L				x	x	x	x	x	x
18	46 to 49[c]	M	L						x	x	x	
19	50 to 56	L	L				x			x	x	
20	59 to 61[d]	L	L						Embank-ment only			
21	61 to 67[d]	M	L				x			x		
21	67 to 69[d]	M	L				x			x		
23	W of 78[d]	L	L									
23	E of 78[d]	M	M									
24	E of 83	M*	M*							x		
25	N of 85[d]	M*	L		x					x		
26	93 to 95[d]	L	L									
30-31	113 to 116	M*	M						x	x	x	
37-38	133 to 136	M	L				x	x	x	x	x	
41	W of 145	M	L				x	x	x	x	x	x
41	W of 147	H	M				x	x	x	x	x	x
42	147&148	L	L									
42	E of 148	M	L						x	x	x	
43	150 & 151	H	L*	x					x	x	x	
43	151 to 153	M*	M*		x					x		
44	E of 156	L	L									
45	157	L	L									
61a/62a	Alt. Segment 14	L	M*	x					x	x	x	x
82	255[e]	L	L	x								

Continued

Table 3.2-4. Mass Wasting Hazard Assessment

Geologic and Hazard Map Page	Stream Crossing or Alternative Route	Hazard Potential		Mitigation Measures								
		Shallow Failure[a]	Deep Failure[b]	Avoidance	Strain gage on pipe	Long Term Monitoring	Drainage	Buttress	Increase Burial Depth	Additional Exploration for Design	Flexible Couplings	Block Valves[f]
The following Mass Wasting locations were found on alternative pipeline routes and are not located within the proposed route.												
61	9a	L	L	x								
61	Alt 3	L	M*	x						x		
61	Alt 13	L	M*	x						x		
62/62a	Alt 13	L	M*		x	x		x		x	x	x
62a	16b-16g	L	L									
62b	N of 16a	L	L									
63a	SE of 24a	L	L									
78a/79	E of 246	alignment	rerouted	x								
80a	250-251	alignment	rerouted	x								
86 & 87	S of 261[e]	alignment	rerouted	x								

[a] less than 10 feet deep
[b] greater than 10 feet deep
[c] occurs on federal lands administered by the U.S. Bureau of Land Management
[d] occurs on federal lands administered by the U.S. Forest Service
[e] occurs on federal lands administered by the U.S. Bureau of Reclamation
[f] block valves that are not shaded correspond roughly to valves OPL is proposing as part of the project at crossings of large rivers/streams (see Table 2-3). They are repeated here to emphasize their importance in minimizing hazards at mass wasting areas as well. The valves that are shaded fall between valves proposed by OPL and are presented here as additional suggested mitigation.

WRT = With Respect To: H = High, M = Moderate, L = Low

* Pending further site investigations

Shading indicates additional mitigation recommended by the EIS team; non-shaded items are part of OPL's proposal.

Source: Based on information provided by OPL and field reconnaissance by the EFSEC consultant team.

measure. Properly implemented, these measures would reduce but not eliminate the potential for impacts resulting from pipeline breakage caused by mass wasting. For example, a block valve damaged by a slide could no longer function as a spill volume reduction mechanism, nor would such a valve completely eliminate a release in the event of pipe breakage.

Stream Crossings and Landslide Areas

Peoples Creek. Potential failure of the slope at Peoples Creek (stream crossing 15) could occur if the pipeline were buried at a shallow depth and became compressed or extended by the sudden or gradual movement of colluvium on the steep hillside. It is very unlikely that backfill can be placed and suitably compacted on the 60-degree, weathered andesite slopes on the lower portion of this hillside, and failure of improperly placed backfill could result in the

uncovering of the pipeline and undermining of support. Rupture of the pipe here could result in the spill of product directly into the creek, which could have a moderate to major environmental impact, depending on how much product reached the stream, the time of year when the spill occurred, and how quickly the spill could be remediated. Peoples Creek drains into the Snoqualmie River 2 km (1.2 miles) downstream of the crossing.

The potential for slope failures along this creek would be mitigated by burying the pipeline below the depth of loose colluvial soil, and by providing in-trench subdrainage on the slope above the rock/soil contact. To design such measures, subsurface explorations would need to be accomplished and detailed geotechnical studies performed.

Cherry Creek. Future movement of existing landslides on the southern slope of Cherry Creek (stream crossing 20) could compress the pipeline at the toe of the slope or extend it at the top of the slope. Such movement could rupture the pipeline, causing spill of product into the creek. The impact could range from moderate to major depending on the size of the spill, the time of year that it occurred, and the time required to remediate it.

OPL has proposed to mitigate the potential for landsliding at this sensitive site by deep burial of the pipeline, and providing long-term monitoring of groundwater levels and ground movements to anticipate and detect potential pipeline ruptures. They would also install block valves at the top of slopes on either side of the valley to reduce the magnitude of any petroleum release. These measures would reduce the potential for a release of product to the stream; they would not serve to stabilize the hillside or appreciably reduce the potential for breakage of the pipeline in the event of a landslide.

Tolt River Valley. Movement at the deep-seated active slide on the south side of the Tolt River Valley (stream crossings 26 and 27) would likely occur either at the top or toe of the slide mass. At the top of the slide the pipe would be pulled apart, whereas at the toe the pipe would be buckled by compression. If the pipe was pulled apart, the spilled product would have about 610 m (2,000 feet) of forested sloping ground to run over before it reached the Tolt River, and because the ground is very pervious, much of the product would infiltrate into the ground. If buckling at the toe ruptured the pipe, product would likely run directly into the Tolt River and result in a moderate to major impact to the stream, depending on the amount of product released and the time required to remediate it.

Design measures proposed by OPL for the Tolt River landslide would include drainage incorporated into the pipeline trench to capture as much subsurface water as possible and improve the stability of the landslide. The earth mass and the pipeline would be monitored with strain gauges on the pipeline and slope inclinometers and groundwater monitoring wells in the ground, all of which should be capable of being monitored remotely. Block valves should be installed on the slopes to the north and south of the creek to reduce the magnitude of a release should a pipe break occur. A subsurface exploration program would be conducted to better understand this slide and to provide information for geotechnical evaluations. These measures would reduce the potential for and impact of a break in the pipeline due to mass wasting. They would not, however, eliminate the potential for released product entering the stream. Such an event could have a minor to major environmental impact on the river depending on the volume of product released and the time when it occurred.

Columbia River. The proposed pipeline route would traverse the middle of a large slide mass above the west shore of the Columbia River (ASC atlas page 62a). Reactivation of the slide, with movement perpendicular to the pipeline, could bend the pipe and cause rupture, resulting in the spill of product into the Columbia River. Such a spill could have a moderate to major environmental impact on the river depending on the volume of product released, the timing of the release, and the response time required to remediate the spill. The mapped landslides just west of the Columbia River (ASC atlas pages 61, 61a, 62 and 62a) would be avoided if the YTC pipeline corridor crossing below Wanapum Dam was used. If the alternate routes are considered, all of them would also avoid the slides except for one segment south of I-90 that ties into the north-south proposed alignment parallel to the west shore of the Columbia River, which would cross through the large landslide shown in the upper center of atlas page 62a. This alternate route would cross the headscarp, perpendicular to the contours such that it would be subjected to extension if the slide reactivated. Extension could result in the spill of product onto the ground and overland flow to the river.

To mitigate the areas where the proposal and alternate routes would cross through the dormant slide mass, OPL proposes to conduct a detailed subsurface exploration program to design a buttress for the slide mass. They would also plan to install a long-term monitoring system, including strain gauges on the pipeline and inclinometers and groundwater level monitors in the ground. These measures would both reduce the potential for and impact of a product release resulting from landsliding.

Seismic Hazards and Liquefaction. Modern steel pipelines with arc-welded joints generally have low vulnerability to damage from ground shaking and gradual lateral/vertical displacement. However, there have been earthquake-induced pipeline failures associated with abrupt ground failures such as fault rupture, slope failures, or lateral spreading of liquefied soils.

Impacts resulting from seismic activity could include pipeline rupture and leakage or spillage into surface water bodies and aquifers. The severity of such an impact would depend on the size of the resulting spill and the response time required for remediation. In the case of a large seismic event, it is anticipated that response time could be lengthened because of competing needs and disruption of infrastructure. Such rupture resulting from a seismic event could occur in the following ways:

- Surface rupture along an active fault could break a pipeline that crosses the fault plane.
- Seismic ground shaking could trigger landslides in areas of marginal slope stability, as discussed above with respect to impacts resulting from mass wasting.
- A bridge or trestle crossing that was not adequately designed or maintained to withstand sufficient seismic shaking could collapse and rupture the pipeline, releasing product into the underlying stream or river.
- Liquefaction of the soils surrounding the pipeline could result in the pipeline becoming buoyant, allowing it to float up toward the ground surface while the soil is in a liquefied state. Similarly, liquefaction could result in differential settlement of the soils underlying the pipeline. Although modern steel pipelines are flexible and can tolerate some gradual movement, either condition could result in stress or breakage of the pipeline.

- Lateral spreading can cause large transverse displacements that could result in breakage of the pipeline. Pipe failure could occur by lateral bending at the edge of the liquefied zone where the pipe runs across the spreading direction, or by compressive buckling where the pipe runs down a slope underlain by liquefied soil.

The pipeline, pump stations, and loading facility would include conservative seismic design and performance criteria specific to the anticipated seismic risks in their locations. Foundation designs would include parameters to minimize impacts from ground shaking and ground rupture which could result in adverse impact to the pipeline and associated structures. These designs would be based on borings or other geotechnical studies accomplished to develop site-specific measures to be incorporated into the pipeline and facility design.

In addition, where feasible, the pipeline corridor has been selected to avoid mapped active or Quaternary faults which are particularly sensitive to seismic events. In areas where liquefaction or lateral spreading poses a hazard, site exploration and data analysis would be performed to select an appropriate construction technique to mitigate the potential for damage to the pipeline. Studies have been conducted to evaluate existing bridges that would be used to support the pipeline. Upgrades and repairs would be implemented where studies indicate the structures are not sufficiently stable to withstand the design earthquakes. Other potential design measures proposed by OPL for impacts resulting from seismic shaking and liquefaction are described in Appendix C.

With proper engineering design and adequate explorations to identify liquefiable soils, these measures should greatly reduce the potential for pipeline rupture due to liquefaction and the resultant impacts. Additional measures recommended to reduce the impact that might result from surface fault rupture along the Saddle Mountains Fault are described under "Additional Proposed Mitigation Measures".

Scouring and Lateral Migration. Changes in stream hydraulics as a result of constructing the pipeline crossings could have long-term effects on stream channel stability. One of these effects could be the increased potential for scouring or lateral migration, and the resultant exposure and damage of the buried pipeline within the stream.

Stream scouring could result in locally lowering the streambed and exposing the buried pipeline. Such an occurrence would likely happen during flooding, at a time when sediment or debris transport was at a peak and would have the greatest potential to damage the exposed pipeline. A pipeline breakage resulting from scour would result in spillage or leakage of fuel directly into the stream and rapid transport of the product to receiving waters.

Rapid lateral migration of a stream channel could also uncover the pipeline where it had been buried within the stream floodplain, exposing it to potential damage from sediment and debris transport. The pipe could also be damaged if lateral migration or scour removed the soil covering the pipe, allowing it to float out of its trench. Stress caused by such floatation could possibly break the pipe, resulting in discharge of product directly into the stream.

The watercourses the pipeline corridor would cross include large meandering streams that drain the west side of the Cascade Mountains and Puget Sound; steep-gradient, high-energy mountain

streams where the corridor would cross the Cascades near Snoqualmie Pass; and relatively low-energy streams that drain the semi-arid plains of eastern Washington. Consequently, a wide range of hydrologic, geologic, biologic, climatic, and watershed-use factors would need to be considered in designing stream crossings for the pipeline. Specifically, these factors would have to be evaluated to assess the long-term impacts of stream erosion in order to determine how deep the pipeline would need to be placed in order to remain safely below the potential scour depth. This depth would have to be determined not only in the present-day channel, but also across the full width of any floodplain that could experience lateral migration of the channel.

Potential measures proposed by OPL to reduce the impacts from pipeline breakage resulting from stream scour and lateral migration include the following:

- Those streams determined to be scour critical, based on a screening-level study of scour potential conducted by OPL, would require a detailed analysis of geomorphology, hydrology, hydraulics, and sediment transport to determine the depth that the pipeline would be buried.

- Pipe burial depths below scour level would be used for the full width of the stream floodplains where lateral migration could occur, not just the streambed.

- BMPs for minimizing the construction footprint and controlling erosion within and adjacent to stream crossings would be applied to minimize disruption of the streambed and adjoining areas (see Appendix C for BMPs).

- The pipeline would be encased in concrete at stream crossings to reduce the effects of buoyancy in the event that overlying soils were eroded. Such a coating would also protect the pipeline from impact in the event that it was exposed by stream erosion and provide an improved ability to withstand undermining of the pipeline.

The level of investigation proposed by OPL to evaluate scour and lateral migration potential at most stream crossings would not be adequate to determine sufficiently conservative burial depths for the pipeline along much of the proposed route. Consequently, these measures alone would not sufficiently reduce the potential for stream erosion to expose the pipeline, which could, in turn, result in releases of product directly into streams during storm runoff events. Therefore, additional mitigation measures are recommended later in this section.

Operational Impacts - Columbia River Approach Options. Geological operational impacts for the YTC segment and other options would not differ from those for the proposed pipeline corridor with the exception that the risk of a release caused by landsliding would be reduced for all options except the one that would pass through the large landslide mass shown on ASC map atlas page 62a.

Operational Impacts - Columbia River Crossing Options. Use of the Burlington Northern Beverly Railroad Bridge in its current condition could pose an unacceptable risk of pipeline breakage during the life of the project. If this option were selected, structural rehabilitation

of the bridge abutments may be required, pending a more detailed review of the structural integrity of the bridge and its abutments.

Cumulative Impacts. Increased risk of negative cumulative effects to watersheds could result from erosion in watersheds with harvested and roaded areas upstream; multiple pipeline crossings (see the discussion in Section 3.6); disturbances by wildlife; heavy winter applications of sand and gravel to highways and roads; other near-stream ground disturbing activities; and others. Turbidity of the water column would result in temporary impacts, even on a cumulative basis. Cumulative effects could be more pronounced in basins that would contain numerous invasive crossings of streams (e.g., South Fork Snoqualmie River), where sediment from several tributaries would be transported to a mainstem system. High fine sediment concentrations in the streambed often have negative implications for aquatic ecology. However, after construction, and after revegetation and other stabilization measures are in place, no cumulative impacts are anticipated. Cumulative effects on water quality are discussed in more detail in Section 3.6.

3.2.2.2 No Action

Without the proposal, there would be no impacts to geology or soils. Geotechnical issues would have no impact on increased trucking and barge activity.

3.2.3 Additional Proposed Mitigation Measures

3.2.3.1 Construction Mitigation and Subsequent Impacts

Columbia River Crossing. To improve the chances of successful construction of the horizontal boring under the Columbia River, while reducing the potential for releases of drilling fluid from the bore to the stream, several additional mitigation measures are proposed. They would involve detailed data gathering prior to construction and carefully applied practices during the actual boring, as described below:

- Involve qualified contractors in the planning and implementation of this crossing. Contractors could be retained to provide a preliminary project feasibility study and initial drill alignment. Such a feasibility study may indicate additional problems that would not otherwise be identified until during the drilling operation. Once the project is underway, an experienced and pre-qualified driller should always be on the drill rig. This may require pre-qualification of drilling contractors, as well as having certain personnel on the job at all times.

- Perform additional explorations to better determine ground conditions before developing the final design for the pipeline crossing. Of greatest use would be a test horizontal directional drilling program to determine the feasibility of constructing a full-scale crossing. This may be the only way to substantially improve upon the current understanding of site conditions. Such a pilot test bore would provide insight on how to

accomplish the crossing with the least potential for a release of drilling fluids. It would also provide data for potential contractors to prepare a reasonable bid to do the work.

Regardless of the explorations that are conducted in advance, horizontal directional drilling in highly permeable, coarse-grained sand, gravel, cobbles, and boulders such as those underlying the Columbia River could be problematic because of the potential for loss of fluid circulation and the instability of the bore. There is a significant potential for collapse of the hole, which could result in the loss of both the bore and the drilling tools. Similarly, stopping during the final pull in such soils could result in lockup of the pulling string and cause loss of the bore. There is also a potential for a release of drilling fluids to the river, either as a result of leakage through the permeable stream deposits, or by hydrofracturing the formation in an attempt to free drilling tools from a collapsed boring. Such a release could have a water quality impact on the river. It could also result in a much longer construction schedule than is planned and greater disruption of the near-shore environment than would otherwise occur.

- If the soil conditions are as currently anticipated, measures to improve the bore stability would greatly improve the potential for a successful horizontal bore under the Columbia River. One such measure would be to pre-assemble the entire pipe to allow the contractor to install the pipeline in one continuous pull. This would eliminate the need for stopping the pull to weld on additional pipe. Complete grouting of the hole during drilling should also be considered to help stabilize the formation. Based on the current understanding of the soil conditions, these additional mitigation measures could be critical to the successful completion of this bore, and would reduce the potential for circumstances which could result in leakage of drilling fluids into the river.

- Consideration should also be given to use of a polymer drilling fluid that would break down and have less impact on the aquatic environment than would bentonite in the event that it was released to the river.

Ginkgo Petrified Forest State Park

- A geologic survey of surficial and near-surface deposits should be considered within Ginkgo Petrified Forest State Park to identify a route that would minimize destruction of the fossil beds. Use of an existing maintenance road should be considered for the pipeline trench, and a minimal width for the pipeline corridor should be considered where construction could otherwise disturb the fossil beds.

3.2.3.2 Operational Mitigation and Subsequent Impacts

Landslides. Table 3.2-4 provides an overview of additional measures suggested to reduce mass wasting impacts (see shaded items). Specific measures include:

- Geotechnical investigations should be performed at the mass wasting areas having either high or moderate potential for slope failure. These investigations would help to define the

slide potential and to identify practical and effective measures to reduce the potential for slope failure.

- On the rock portion of the slope at the Peoples Creek crossing, and in similar environments, the backfill in the trench should be concrete to buttress the slope and protect the pipe. To design such measures, subsurface explorations should be accomplished and detailed geotechnical studies performed.

- Block valves south of the slide and on the slope north of Cherry Creek should be required to stop flowing product in the event that pipeline or ground movement is detected. Because most of the earth movement at this site is caused by surface and subsurface water, drainage mitigation measures would likely be the most effective means for increasing the stability of the slope. While increased depth of pipe burial could be effective, a subsurface exploration program would be necessary to determine if other measures such as buttressing would be required to stabilize the hillside and the pipe.

- Flexible couplings should be considered at the top and toe of the landslide along the south slope of the Tolt River Valley to allow for creep movements of the earth mass. Pipeline block valves should be considered at this location. Additionally, block valves should be installed south of the top of the slide area and on the slope north of the Tolt River in the event pipeline or ground movement is detected.

- For the proposed routes and the alternatives that traverse a large landslide west of the Columbia River crossing, additional measures should be considered to further reduce the impact of a landslide-related pipeline break and product release into the Columbia River. Pipeline block valves installed at the west side of the slide would allow for a shut-off of product flow in the event that pipeline or ground movement were detected or breakage were to occur. This measure, along with measures proposed by OPL, would both reduce the potential for and magnitude of a product release into the Columbia River.

Fault Rupture. Along the Saddle Mountains, the corridor would cross an area where the buried extension of the active Saddle Mountains fault may exist. The potential for surface rupture along this fault requires further evaluation during design. If the fault extends under the pipeline alignment, mitigation could include:

- installation of flexible couplings across the fault zone,
- use of reinforced pipe with increased wall thickness to reduce the potential for breakage, and/or
- installation of block valves to minimize a potential release in the event of a rupture.

Stream Scour and Lateral Migration. Several additional mitigation measures are described below that would reduce the potential for breakage of the pipeline by stream scour and lateral migration. These measures should significantly reduce the potential for impacts resulting from breakage of the pipeline as a result of stream scour. Because of limitations in the current understanding of stream and hillslope processes, it is not feasible to completely eliminate the potential for such impacts.

- Detailed evaluations of scour potential at individual stream crossings would be required to determine appropriate depths of pipeline burial to minimize the potential for exposure of the pipeline. The depth of burial would need to exceed this estimated scour depth by a conservative factor to account for uncertainties in the scour evaluation. The generalized screening level approach accomplished to date by OPL would be useful in evaluating the scour potential of low gradient (1 to 2 percent) streams with respect to fluvial sediment transport processes. However, the scour potential of steeper gradient streams, including all of those within the Cascades, needs to be reevaluated to consider the high shear stresses applied to the beds of these streams. The scour evaluations also need to consider the effects of rapid gully advancement in steep disturbed streams, flow constrictions, log jams, debris flows, and headward migration resulting from stream degradation, all of which have been observed at or near proposed stream crossings.

- In areas where scour studies indicate that the potential scour depth would exceed reasonable trenching depths, the stream crossings could be accomplished by horizontal directional drilling.

- Block valves could be used on streams where there is a high or unpredictable scour potential to reduce the impact of a pipeline break that occurred as a result of a rapid scouring event.

- For areas where the pipeline would be placed in an embankment above or below existing culverts, studies would be necessary to confirm that the culverts are adequately sized to accommodate peak flood events. Within the Wenatchee National Forest, larger culverts would be required to prevent flood events from eroding the embankment and risking breakage of the pipeline. (The ASC indicates that undersized culverts that are identified will be replaced as a pipeline construction mitigation measure.) Where these areas are susceptible to mudflows and debris flows, consideration should be given to horizontal directional drilling and installation of block valves.

- If horizontal directional drilling is selected for the Columbia River crossing, a flood study should be done to assess if floodwaters would cover the launch and receiving pit areas during design peak flows. If so, provisions would be necessary to protect the pipeline from damage that could be caused by scour where it enters and leaves the bored crossing. Such measures could include use of energy dissipaters, riprap, or other bank protective measures designed for the specific application.

Seismic Stability. If the Beverly Railroad Bridge alternative is to be used for the Columbia River crossing, a detailed structural analysis and seismic stability analysis will be necessary to determine whether substantial rehabilitation of the bridge is necessary.

The trench excavated for pipeline installation should be specially designed to maximize pipeline flexibility in case of seismic events. Such construction should consist of 1:1 sloped trench sidewalls and placement of free-draining backfill in the trench.

3.3 BOTANICAL RESOURCES

3.3.1 Affected Environment

This section presents information about botanical resources and plant communities existing along the proposed pipeline corridor. This section also discusses the following botanical resources that are considered important by the USFS and other state and federal agencies that manage natural resources because of their sensitive habitat features or uniqueness in the region:

- threatened, endangered, and sensitive plant species;
- "survey and manage" plant species associated with old-growth forest; and
- unique high-quality native plant communities.

Noxious weeds are also discussed because of the importance of minimizing the spread of these species. Unless otherwise noted, information presented is based on field surveys, information presented in the ASC (OPL 1998), and technical reports prepared for this proposal (Dames & Moore 1997). The scientific names of plant species are provided in Table 3.3-1. Common names are used in text for ease of reading.

3.3.1.1 Plant Communities

The pipeline corridor would traverse a landscape that is affected by a broad range of factors such as climate, soil, elevation, and exposure, all of which influence vegetation patterns. Generalized vegetation maps of Washington identify major vegetation zones that recognize the different geographic and physiographic conditions throughout the state. Based on a vegetation analysis of the natural vegetation of the Pacific Northwest (Franklin and Dyrness 1988), the pipeline corridor crosses the following major plant communities:

- western hemlock and mixed conifer forest from the corridor's origin near Woodinville to the upper slopes of the west Cascade Mountains beyond the City of North Bend;

- subalpine forests that include Pacific silver fir and mountain hemlock at Snoqualmie Pass;

- Douglas fir and grand fir forests along the east side of the Cascade Mountains from below Snoqualmie Pass to the Ellensburg area; and

- shrub-steppe communities, which include shrubs such as big sagebrush and bitterbrush and a variety of grasses and forbs, from Ellensburg to the corridor's endpoint at Pasco.

Field studies and aerial photograph interpretation were conducted in 1995, 1996, and 1997 to map the dominant vegetation cover types. Vegetation was mapped within a 0.8 km (0.5-mile) study area centered along the pipeline corridor (and alternative Columbia River crossings). Field studies focused on a 61 m (200-foot) wide study corridor along the centerline of the pipeline corridor.

Table 3.3-1. Common and Scientific Names of Plant Species

Common Name	Scientific Name	Common Name	Scientific Name
big-leaf maple	*Acer macrophyllum*	needle-and-thread grass	*Stipa* spp.
big sagebrush	*Artemesia tridentata*	noble polypore	*Oxyporous nobilissimus*
bitterbrush	*Purshia tridentata*	Northern wormwood	*Artemisia campestris* ssp. *borealis* var. *wormskioldii*
black cottonwood	*Populus trichocarpa*	orange hawkweed	*Hieracium aurantiacum*
blackberry	*Rubus* spp.	orchard grass	*Dactylis glomerata*
bluebunch wheatgrass	*Agropyron spicatum*	Oregon (Wenatchee) checkermallow	*Sidalcea oregana* var. *calva*
boreal bedstraw	*Galium kamtschaticum*	Oregon white oak	*Quercus garryana*
bracken fern	*Pteridium aquilinum*	oxeye-daisy	*Chrysanthemum leucanthemum*
buckbrush	*Ceanothus velutinus*	Pacific silver fir	*Abies amabilis*
bulbous bluegrass	*Poa bulbosa*	Paiute suncup	*Camissonia scapoidea*
Buxbaum's sedge	*Carex buxbaumii*	pauper milk-vetch	*Astragalus misellus* var. *pauper*
cheatgrass	*Bromus tectorum*	ponderosa pine	*Pinus ponderosa*
clover	*Trifolium spp.*	quaking aspen	*Populus tremuloides*
colonial bentgrass	*Agrostis tenuis*	rabbitbrush	*Chrysothamnus* spp.
Columbia milk-vetch	*Astragalus columbianus*	red alder	*Alnus rubra*
common snowberry	*Symphoricarpos albus*	red top	*Agrostis alba*
Coyote tobacco	*Nicotiana attenuata*	Russian olive	*Elaeagnus angustifolia*
Desert evening primrose	*Oenothera cespitosa*	salal	*Gaultheria shallon*
Douglas-fir	*Pseudotsuga menziesii*	salmonberry	*Rubus spectabilis*
Dwarf evening primrose	*Oenthothera pygmaea*	Scot's broom	*Cytisus scoparius*
fiddleneck	*Amsinckia lycopsoides*	Snake Canyon desert-parsley	*Lomatium serpentinum*
filaree	*Erodium cicutarium*	Southern mudwort	*Limosella acaulis*
golden paintbrush	*Castilleja levisecta*	spiney hopsage	*Atriplex spinosa*
grand fir	*Abies procera*	stiff sagebrush	*Artemisia rigida*
Gray cryptantha	*Cryptantha leucophaea*	sword fern	*Polystichum munitum*
greasewood	*Sarcobatus vermiculatus*	tall Oregon grape	*Mahonia aquifolium*
hazelnut	*Corylus cornuta*	thistle	*Cirsium* spp.
Hoover's desert parsley	*Lomatium tuberosum*	three-leaved foam flower	*Tiarella trifoliata*
Hoover's tauschia	*Tauschia hooveri*	tumblemustard	*Sisymbrium altissimum*
huckleberry	*Vaccinium* spp.	western hemlock	*Tsuga heterophylla*
Idaho fescue	*Festuca idahoensis*	western red cedar	*Thuja plicata*
Indian ricegrass	*Oryzopsis* spp.	White eatonella	*Eatonella nivea*
knapweed	*Centaurea* spp.	wild rose	*Rosa* spp.
mock azalea	*Menziesia ferruginea*	willow	*Salix* spp.
mountain hemlock	*Tsuga mertensiana*	vine maple	*Acer circinatum*

The plant communities encountered within the study area and the major vegetation zone(s) in which they occur are shown in Table 3.3-2. Descriptions of these plant communities are summarized below from the vegetation technical report and vegetation maps (Dames & Moore 1997). The conditions of the plant communities along the corridor are representative of the land management activities that have occurred in Washington during the last 100 years. Timber harvests, utility corridor maintenance activities, agricultural practices, and development have affected the majority of the vegetation conditions in the communities. Acreages of plant communities within the construction corridor are described in the "Environmental Consequences" subsection.

Table 3.3-2. Plant Communities Mapped in the One-Half-Mile Study Area and the Major Vegetation Zones in Which They Occur

	Major Vegetation Zones			
Cover Type	**Western Hemlock**	**Subalpine Fir (Pacific Silver Fir and Mountain Hemlock)**	**Douglas Fir and Grand Fir**	**Shrub-Steppe**
Western Hemlock	X	X		
Silver Fir	X	X		
Mountain Hemlock		X		
Douglas Fir	X	X	X	
Ponderosa Pine			X	
Deciduous Forest	X	X	X	X
Mixed Forest	X		X	X
Young Regenerating Coniferous Forest	X	X	X	
Old-Growth Forest	X	X		
Scrub-Shrub	X	X	X	X
Shrub-Steppe				X
Grass/Forb	X		X	X
Cropland			X	X
Hay/Pasture	X		X	X
Orchard			X	X
Developed (vegetated)	X	X	X	X
Wetland	X	X	X	X

Note: Cover types from Dames & Moore (1997).

The proposal is located in a mix of natural vegetation and converted vegetation types (e.g., cropland, orchards, hayfields, and pastures), or along utility corridors where disturbance has already occurred. Native vegetation occurs within these vegetation communities, but forested areas are dominated by second- and third-growth forest. Many of the scrub-shrub communities identified in the study area are associated with the BPA ROW where vegetation management activities maintain

the scrub-shrub vegetation. Native and non-native grass species are present in shrub-steppe communities as a result of grazing and other past land management.

Conifer Forests. Within the study corridor, the coniferous forests of the Puget Lowlands and the lower western slopes of the Cascade Mountains are dominated by second-growth Douglas fir and western hemlock. Western red cedar occurs occasionally and can be a co-dominant species in some forests. Big-leaf maple and red alder are intermittent within these forests but account for less than 25 percent of the total forest cover. Common understory plants include salmonberry, blackberries, salal, Oregon grape, vine maple, snowberry, and sword fern.

Pacific silver fir is found on the upper western slopes of the Cascade Mountains. Species mentioned above are also associated with conifer forest dominated by Pacific silver fir. The crest of the Cascades at Snoqualmie Pass is dominated by Pacific silver fir and mountain hemlock. Common understory species include huckleberry, mock azalea, and salmonberry. Although mountain hemlock dominated forest occurs at Snoqualmie Pass, the pipeline corridor crosses this area through an existing tunnel, avoiding this community type.

On the east slopes of the Cascade Mountains, much of the pipeline corridor is conifer forest dominated by Douglas fir, grand fir, or ponderosa pine. As the rainfall decreases toward the east, ponderosa pine tends to be a lone dominant species in the driest forests. Common understory shrubs on the east side of the Cascades include huckleberry, Oregon grape, snowberry, and buckbrush. The driest ponderosa pine forest may include bitterbrush and big sagebrush as understory species.

Young regenerating coniferous forests include tree farms and recently planted clearcuts dominated by Douglas fir and western hemlock. Other conifer species may be present depending upon species planted or naturally regenerating. Understory vegetation in these forests includes young red alder, blackberry, salmonberry, sword fern, and bracken fern.

Stands of old-growth forest occur in the 0.8 km (0.5-mile) study area, but none occur within the proposed 18.3 m (60-foot) construction corridor. Patches of old growth within the half-mile study area occur primarily on the western slopes of the Cascade Mountains (between approximately MP 13 and 59) and are dominated by western hemlock or silver fir.

Deciduous Forest. Deciduous forests occur on both sides of the Cascade Mountains, although within the 18.3 m (60-foot) construction corridor, most of this community type occurs west of Snoqualmie Pass. Deciduous forest is found primarily in patches along residential and commercial areas of Snohomish and King Counties and along riparian corridors. Big-leaf maple and red alder are the dominant species.

East of the Cascade Mountains, patches of quaking aspen are scattered in moist sites; small aspen groves and Oregon white oak occur in the study area at Swauk Creek in Kittitas County. Much of the deciduous vegetation in eastern Washington occurs in the wetlands and includes willow species and Russian olive (see Section 3.4, Wetlands).

Mixed Forest. Mixed forest communities are dominated by both coniferous and deciduous trees (i.e., cover of both coniferous and deciduous trees is greater than 25 percent). This community

is found primarily west of the Cascades and is dominated by western hemlock, Douglas fir, big-leaf maple, and red alder.

Scrub-Shrub. Scrub-shrub vegetation primarily occurs in intensively managed areas (e.g., BPA transmission line ROW) in western Washington. Other scrub-shrub areas include riparian areas adjacent to streams. Commonly occurring shrubs in western Washington include vine maple, young black cottonwood, Scotch broom, salal, blackberries, salmonberry, hazelnut, wild roses, snowberry, and young alder and willows.

Shrub-Steppe Communities. The shrub-steppe vegetation zone is the predominant vegetation cover type along the study corridor in eastern Washington. Shrub-steppe vegetation is considered an important habitat by the Washington Department of Fish and Wildlife (WDFW), Washington Natural Heritage Program (WNHP), and U.S. Fish and Wildlife Service (USFWS). Shrub-steppe is considered important because of the limited occurrence of undisturbed, high-quality shrub-steppe habitat and the associated habitat features that support native plant and animal species in the eastern Washington Columbia Basin. Today, approximately 5 percent of the historic extent of shrub-steppe vegetation is considered to be in a relatively undisturbed condition based on estimates by the WNHP. The WDFW considers undisturbed shrub-steppe habitat to be a priority habitat type because of its limited occurrence and habitat features important to wildlife species (WDFW 1996).

Because of the importance of this vegetation type, detailed field studies were conducted to identify the type and condition of plant communities within the shrub-steppe zone. Vegetation mapping of these different communities was based on the dominant shrub and grass species present (i.e., percent cover). The condition of the shrub-steppe communities was based on the amount of disturbance to the cryptogam crust commonly associated with shrub-steppe communities (a layer of mosses and lichens growing on the ground surface between grasses and shrubs); evidence of grazing; road scars or off-road vehicle use; habitat fragmentation by roads or other development; herbicide overspray from nearby agricultural or roadside vegetation; and the presence of non-native grass species such as cheatgrass or bulbous bluegrass.

A total of 23 plant community types were identified in the shrub-steppe zone along the 61 m (200-foot) study corridor including the alternative YTC and Columbia River segments (Table 3.3-3). These communities can be grouped into three general types: (1) communities dominated by native shrubs and native grasses (at least 80 percent of the grass cover is native grasses); (2) native shrubs with a mix of native and non-native grasses; and (3) native shrubs with non-native grasses (at least 80 percent of the grass cover is non-native grasses). Several of the community types are dominated by a single grass species (at least 70 percent cover of the single grass species with shrub cover lacking), or just a shrub species without a significant grass cover.

Most of the shrub steppe community contains non-native grasses; 26 percent of the shrub-steppe area in the study corridor is predominantly native grass understory. Some cheatgrass and/or bulbous bluegrass is generally present in these native grass communities as discussed above.

Table 3.3-3. Shrub-Steppe Plant Communities Mapped in the 200-Foot Study Corridor

- Sagebrush/rabbitbrush/cheatgrass
- Sagebrush/native grasses
- Buckwheat/native and nonnative grasses
- Bitterbrush/sagebrush/native and nonnative grasses
- Sagebrush/rabbitbrush/cheatgrass/native grasses
- Bitterbrush/native and nonnative grasses
- Rabbitbrush/native grasses
- Sagebrush/cheatgrass/native grasses
- Rabbitbrush/buckwheat/native and nonnative grasses
- Cheatgrass
- Wildrye
- Sagebrush/cheatgrass
- Rabbitbrush/cheatgrass
- Sagebrush/rabbitbrush/native grasses
- Bitterbrush/rabbitbrush/native grasses
- Native grasses
- Spiney hopsage
- Sagebrush/spiney hopsage/native and nonnative grasses
- Sagebrush/buckwheats/native and nonnative grasses
- Greasewood/cheatgrass
- Greasewood/sagebrush/cheatgrass
- Rabbitbrush/sagebrush/bitterbrush/cheatgrass/ native and nonnative grasses
- Rabbitbrush/sagebrush/bitterbrush/native and nonnative grasses

Source: OPL (1998) and other information provided by Dames & Moore.

In almost all of the shrub-steppe communities, however, disturbance of the habitat is evident from the absence or disruption of the cryptogam crust, livestock grazing, off-road use, or other disturbances mentioned above. Where the cryptogam crust is intact, it is limited primarily to under the shrubs where it is more protected from grazing and human disturbance. One area of shrub-steppe habitat that was relatively undisturbed is discussed later in this section under "Unique Plant Communities".

The largest areas of shrub-steppe habitat along the study corridor are located between the town of Kittitas and the Columbia River. The primary land use in this area is grazing, which has disturbed the shrub-steppe plant communities (i.e., broken cryptogam crust and presence of non-native grass and forb species). East of the Columbia River, the shrub-steppe communities are more patchy and fragmented along the study corridor and have been disturbed to a greater extent by grazing, agricultural practices, development, and herbicide spraying. Small patches of shrub-steppe habitat with native grasses occur between irrigated crop circles and roads.

Herbaceous Communities. Herbaceous plant communities along the pipeline corridor are relatively rare and are composed of weedy, non-native grasses and forbs. West of the Cascade Crest, these herbaceous areas occur in previously disturbed areas such as roadsides, vacant lots that have been cleared, and abandoned pastures. Dominant plant species include orchard grass, redtop and colonial bentgrass, thistle, sword fern, ox-eye daisy, fescue, and clover. East of the Cascade Crest, herbaceous communities are dominated by cheatgrass, tumblemustard, filaree, fiddleneck, and knapweed.

Agricultural Communities. Agricultural plant communities occur throughout the study area, except for the mountainous portion of the corridor between approximately the Cities of North

Bend and Easton. For a discussion of agricultural communities present see Section 3.13, Agriculture.

Kittitas Terminal and Pump Stations. The site of the Kittitas Terminal is approximately 10.9 ha (27 acres) and is currently cropland. The five pump station sites are each approximately 0.4 to 0.8 ha (1 to 2 acres) and have the following vegetation types:

- The Thrasher Station site at MP 0.0 is dominated by native and non-native grasses and forbs, Scotch broom, and a few scattered Douglas fir trees.
- The North Bend site (MP 37.3) is presently used as pasture.
- The Stampede Station (MP 67.2) is a small developed area with a gravel parking lot, a building, and scattered Douglas fir trees.
- The Beverly-Burke (MP 154.0) and Othello Station (MP 189.5) sites are cropland.

3.3.1.2 Threatened and Endangered Plant Species

Threatened, endangered, and candidate plant species have been identified by the USFWS as plants to be protected under the Endangered Species Act of 1973. The USFWS has published a list of threatened and endangered plant species (58 FR 51144, September 30, 1993) and a list of proposed threatened, endangered, and candidate species (61 FR 7596, February 28, 1996; 50 CFR 17.12).

A letter issued by the USFWS indicated that no listed plants, candidate plants, or plants proposed for designation as threatened or endangered under the Endangered Species Act are known to occur in the study area. Since the time when the USFWS was contacted for the ASC, however, the USFWS has listed golden paintbrush as a threatened plant species, and Wenatchee checkermallow as a proposed candidate species (Propp pers. comm.). Both species have the potential to occur along the pipeline corridor, based on information provided by the USFWS.

The USFWS also maintains a list of species of concern that are not considered threatened, endangered, or candidate species, but whose conservation standing is a concern to the USFWS. According to USFWS, additional information is still needed on distribution and population numbers to determine whether species of concern should be considered threatened, endangered, or candidate. Species of concern that could potentially occur in the project area are listed in Table 3.3-4.

Table 3.3-4. Sensitive Plant Species and USFWS Species of Concern that Occur, or Have the Potential to Occur, in the One-Half-Mile Study Area Based on Database Information

Common Name	Scientific Name	USFS, State (S), or USFWS Status
Plants Known to Occur Based on WNHP Database		
Buxbaum's sedge	*Carex buxbaumii*	Sensitive - USFS, S
Columbia milk-vetch	*Astragalus columbianus*	Threatened - S
Coyote tobacco	*Nicotiana attenuata*	Sensitive - USFS Threatened - S
Desert evening primrose	*Oenothera caespitosa*	Sensitive - S
Dwarf evening primrose	*Oenthothera pygmaea*	Threatened - S
Gray cryptantha	*Cryptantha leucophaea*	Sensitive - S
Hoover's desert parsley	*Lomatium tuberosum*	Threatened - S Species of Concern - USFWS
Hoover's tauschia	*Tauschia hooveri*	Threatened - S Species of Concern - USFWS
Paiute suncup	*Camissonia scapoidea*	Sensitive - S
Snake Canyon desert-parsley	*Lomatium serpentinum*	Sensitive - S
Southern mudwort	*Limosella acaulis*	Sensitive - USFS, S
White eatonella	*Eatonella nivea*	Threatened - S
Plants Which May Have the Potential to Occur Based on USFWS Information		
Golden Indian-paintbrush	*Castilleja levisecta*	Endangered - S Threatened - USFWS
Northern wormwood	*Artemisia campestris* ssp.*borealis* var. *wormskioldii*	Endangered - S Species of Concern - USFWS
Oregon (Wenatchee) checkermallow	*Sidalcea Oregana* var. *calva*	Endangered - S Proposed candidate - USFWS Sensitive - USFS

Source: Dames & Moore (1997) and other information provided by Dames & Moore.

3.3.1.3 Sensitive Plant Species

In addition to plants considered threatened, endangered, or candidate species by the USFWS, other state and federal agencies identify sensitive plant species for which population viability is a concern. Agencies contacted to identify sensitive species that may be present along the corridor include the following:

- The WNHP maintains a list of plant species whose population viability is considered threatened, endangered, or sensitive (WNHP 1994). The Bureau of Land Management refers to the WNHP list.

- The Mt. Baker-Snoqualmie National Forest (MBSNF) and Wenatchee National Forest (WNF) maintain lists (from the USFS Region 6 list) of those vascular plant species identified by a regional forester for which population viability is a concern (Potash 1991, Smith-Kuebel and Lillybridge 1993).

- The Department of the Army maintains a list of sensitive plants on the YTC.

Field surveys for threatened, endangered, and sensitive plant species as identified by the above agencies were conducted using the MBSNF standard operations for plant program field methods on federal lands and in shrub-steppe plant communities. In addition, a database search by the WNHP identified 12 species that are known to occur within the vicinity of the half-mile study area (Table 3.3-4). These recorded occurrences do not lie within the 18.3 m (60-foot) construction corridor.

During the field surveys, populations of two sensitive plant species were found along the 61 m (200-foot) study corridor: pauper milk-vetch and Piper's daisy. Populations of Columbia milk-vetch were found on Columbia River crossing alternative segments south of the pipeline corridor and west of the Columbia River, and desert evening primrose was found on the Beverly Railroad Bridge crossing alternative routes east of the Columbia River. Populations of Hoover's tauschia were found along the alternative segment south of I-90 in the YTC. The general location and population size of these species are shown in Appendix E and Table 3.3-5.

Table 3.3-5. Size and Location of Sensitive Plant Species Populations Observed During Field Surveys in the 200-Foot-Wide Study Corridor

Common Name	Scientific Name	Population Size	Location	Federal Lands
Columbia milk-vetch	*Astragalus columbianus*	Two populations (size not determined)	Kittitas County T16N R22E S1 T17N R22E S36	--
Desert evening primrose	*Oenothera caespitosa*	Two populations (size not determined)	Kittitas County T16N R23E S33	--
Hoover's tauschia	*Tauschia hooveri*	Two populations of 100 individuals each	Kittitas County T17N R21E S27	DOD
Pauper milk-vetch	*Astragalus misellus* var. *pauper*	One population (size not determined)	Kittitas County T17N R20E S14	--
Piper's daisy	*Erigeron piperianus*	Two populations of 6 and 10 individuals	Grant County T16N R25E S11	BOR
		One population of 100 individuals	Adams County T15N R28E S23	BOR

DOD = U.S. Depatrment of Defense (Yakima Training Center) administered federal lands.
BOR = U.S. Bureau of Reclamation administered federal lands.

3.3.1.4 Survey and Manage Plant Species

"Survey and manage" plant species are those associated with late-successional forest within the range of the spotted owl, as referenced in the Record of Decision for the Northwest Forest Plan (USFS/BLM 1994). Because the construction corridor would not pass through any old-growth forest (see the "Unique Vegetation Communities" section), no survey and manage plant species are expected to occur within this corridor. A database search for survey and manage plant species conducted by the MBSNF indicated that no known species are located within the construction corridor, although boreal bedstraw, a flowering plant species, is located within approximately 0.8 km (0.5 mile) of the pipeline corridor.

The Snoqualmie Pass Adaptive Management Area Plan FEIS identifies nine survey and manage plant species that are known to occur in the Snoqualmie Pass area based on herbarium collections inventoried at Central Washington University and the University of Washington (USFS/USFWS 1997). Table 3.3-6 lists the lichen and fungi species closely associated with late-successional and old-growth forests that have been collected or known to occur in the Snoqualmie Pass Adaptive Management Area.

Table 3.3-6. Survey and Manage Lichen and Fungi Species that have been Collected, or Known to Occur in the Snoqualmie Pass Area

Lichens

Hypogymnia duplicata
Lobaria linita

Fungi

Aleurodiscus farlowii
Cantharellus cibarius
Cantharellus subalbidus
Clavariadelphus truncatus
Cortinarius boulderensis
Mycena monticola
Rhodocybe speciosa
Thaxterogaster pingue

Source: USFS/USFWS 1997.

Based on USFS GIS information, the closest known occurrence of a survey and manage plant species to the construction corridor is a fungus located several miles west of Snoqualmie Pass. Noble polypore, a rare fungus, is located approximately 137 m (450 feet) north of the pipeline corridor. Noble polypore typically grows on large-diameter stumps, snags, and living trees. It occurs in late-successional forests, especially in old-growth and ancient stands, and can persist on ancient large stumps in second growth for a number of years. It has not been found growing on logs (USFS 1994). The Northwest Forest Plan states that this noble polypore population should be protected with a buffer of at least 1.6 km (1 square mile) with the fungus population centrally located. The pipeline would be located within this buffer area.

Within the noble polypore buffer area, the pipeline would be placed primarily in an existing road/railroad bed or on the John Wayne Trail with no mature trees being cut. The pipeline would need to cross a segment of forest requiring a 152 m (500-foot) long section of new corridor; in this area, the forest is dominated by young regenerating western hemlock and Douglas fir trees approximately 10 to 36 cm (4 to 14 inches) diameter at breast height. Old-growth conditions supporting noble polypore do not exist within the 152 m (500-foot) long pipeline segment that would pass near the existing fungus population.

Approved survey protocols for the noble polypore have not been issued from the Regional Ecosystem Office. In addition, the proposed pipeline route would not cross through any suitable habitats for this species (i.e., old-growth forest or other areas which have large old-growth tree stumps). For these reasons, surveys for the noble polypore were not conducted. (Surveys for vascular sensitive plant species that are also designated as survey and manage species were conducted as discussed in the "Sensitive Plant Species" subsection earlier. Survey protocol was developed in October 1997 for three lichen and three liverwort species that are closely associated with old-growth forest, but surveys for these species have not yet been conducted.)

3.3.1.5 Unique Plant Communities

None of the vegetation types identified along the pipeline corridor appear to qualify as high-quality natural communities except for a portion of the shrub-steppe habitat along the steep slopes east of the Columbia River. This section describes the basis for this conclusion.

Unique plant communities are high-quality native plant communities of particular concern to land resource management agencies because they are relatively uncommon across the landscape. The MBSNF and the WNF have completed watershed analyses for the South Fork Snoqualmie and Yakima Watersheds (MBSNF 1995, WNF 1997). Unique plant communities identified in these watershed analyses include non-forested areas such as wet and dry meadows, brushfields, wetlands, and subalpine parkland.

The only unique non-forested habitat areas identified by the WNF in the construction corridor are brushfields and several wetlands. The brushfields are associated with cleared forest along the BPA ROW. Wetlands are discussed under Section 3.4, Wetlands.

A WNHP database search identified six high-quality natural communities that could be considered unique vegetation communities in the vicinity of the 0.8 km (0.5-mile) wide study area. However, these communities, or other communities meeting the criteria for high-quality native communities, were not observed along the pipeline corridor or alternative alignments. Based on the locations identified in the WNHP database, the conditions where these communities could possibly occur within the 61 m (200-foot) study corridor are as follows:

- **Western hemlock/sword fern - three-leaved foam flower and red alder communities.** The WNHP identified locations of these high-quality native communities in the vicinity of MP 41. However, field surveys conducted in this area indicate that high-quality native plant communities of this type do not occur along the pipeline corridor. The forested areas in the study corridor are not considered high-quality native communities because the trees are not mature, old-growth conditions do not exist, and the area is disturbed and composed of weedy species along this segment of the corridor.

- **Big sagebrush/bluebunch wheatgrass and stiff sagebrush/Sandberg's bluegrass communities.** These communities could occur along one of the alternative alignments west of the Columbia River and north of I-90, based on WNHP information. Fieldwork identified these communities along portions of the alignment, but they are not considered high-quality because of the broken or missing cryptogam crust, presence of cheatgrass, and evidence of existing land use practices that reduce the habitat value of the area (cattle grazing and off-road vehicles).

- **Big sagebrush/needle-and-thread and tall gray rabbitbrush-bitterbrush/Indian rice grass communities.** These communities, identified by the WNHP, are beyond the one-half-mile study area assessed for this proposal.

Criteria used to determine whether unique or high-quality plant communities occur along the pipeline corridor were based on WNHP (1992, 1996) and WDFW (1996) information. Using these

criteria, none of the vegetation types identified along the pipeline corridor appear to qualify as high-quality natural communities except for a 457 m (1,500-foot) portion of the shrub-steppe habitat along the steep slopes east of the Columbia River. This area is dominated by native grasses and sagebrush with an intact cryptogam crust. The area has not been severely disturbed by grazing or off-road vehicle use and has not been fragmented by roads because of the steep slopes.

No other portion of the corridor is considered to have high-quality native communities because (1) the pipeline uses existing corridors (e.g., roads, BPA ROW, trails, etc.) where vegetation has already been removed or disturbed; and (2) vegetation conditions within new construction corridors have been disturbed to the extent that the area is not considered representative of a high-quality natural community. Examples of disturbance include timber harvest that has resulted in second- and third-growth forest; shrub-steppe communities disturbed by grazing, development, or off-road vehicle use; and the proximity of agricultural and other development activities.

Portions of the shrub-steppe community in the YTC (one alternative route for approaching the Columbia River) contain native grasses and shrubs. However, the area is not considered a high-quality natural community by WNHP standards because of the nearby disturbance of roads, occasional off-road vehicle use from military vehicles, the lack of other intact ecosystem elements such as a cryptogam crust on the soil surface, and the presence of non-native aggressive grasses such as cheatgrass and bulbous bluegrass.

Old-growth forest can be considered a unique plant community because of management decisions that have been made to protect elements of the old-growth forest associated with spotted owls (USFS/BLM 1994). Old-growth forest is also considered a priority habitat by the WDFW (1996). Old-growth forest, as defined by the Northwest Forest Plan, is a forest stand usually at least 180 to 220 years old with moderate to high canopy closure; a multilayered, multispecies canopy dominated by large overstory trees; high incidence of trees, some with broken tops and other indication of old and decaying wood; and numerous large snags and heavy accumulations of wood, including large logs on the ground.

Old-growth forest was identified within the one-half-mile-wide study area centered on the pipeline corridor based on aerial photograph interpretation and ground surveys. Old-growth forest, however, does not occur within the 18.3 m (60-foot) wide construction corridor. Field surveys conducted by Dames & Moore staff and some of which were confirmed by the EIS team have indicated that forest where new corridor would be constructed (i.e., outside of existing roads, trails, and ROWs) is second-growth or young regenerating coniferous forest.

The pipeline corridor would cross through a portion of the MBSNF and WNF designated as a Late-Successional Reserve (LSR) as defined in the Northwest Forest Plan (USFS/BLM 1994). This portion of the corridor is located along the John Wayne Trail, and no trees would be removed along the trail. Approximately 137 m (450 feet) of the route would cut a new 18.3 m (60 foot) wide corridor through second-growth forest within the LSR as described in "Survey and Manage Plant Species" earlier. This portion of the forest is dominated by young western hemlock and Douglas-fir trees 6.1 to 15.2 m (20 to 50 feet) tall with a salmonberry understory. The condition of the forest is representative of second-growth forest throughout western Washington and does not represent unique or rare vegetation.

3.3.1.6 Noxious Weeds

Noxious weeds are non-native weed species that easily invade farmland, decrease forest productivity, and alter ecosystems by out-competing native vegetation. Noxious weeds are commonly annual and perennial forbs. Under the Washington State Weed Law (RCW 17.10.080), noxious weeds are invasive weeds that are difficult to control by cultural or chemical practice. The Washington Noxious Weed Control Board and county noxious weed boards maintains lists of noxious weeds.

Noxious weed lists are also maintained by the MBSNF and WNF. The MBSNF identifies 11 forb species and the WNF identifies 21 forbs and 1 shrub (Scotch broom) as noxious weeds of these national forests (Potash 1991, Smith-Kuebel and Lillybridge 1993). The MBSNF has reported that knapweeds and orange hawkweed are prevalent in the Snoqualmie Pass area, and that the I-90 corridor is a serious noxious weed problem area (MBSNF 1995). The Yakima River watershed analysis identifies ox-eye daisy, Scotch broom, and orange hawkweed along the pipeline corridor (WNF 1997). Other noxious weeds common to eastern Washington include diffuse and spotted knapweed, yellow star-thistle, yellow toadflax, rush skeleton weed, and Canada thistle.

3.3.2 Environmental Consequences

3.3.2.1 Proposed Petroleum Product Pipeline

Construction Impacts. The following discussion of vegetation impacts is based on construction-related loss of vegetation, when ground breaking disturbance and vegetation removal would occur. Functions related to vegetation such as wildlife use, soil retention, water quality, recreation, and aesthetics are discussed in other sections of the EIS.

Types of Construction Impacts. Construction impacts can be characterized as temporary or permanent. Permanent impacts occur where vegetation would be removed for permanent structures (pump stations and terminal facility). Temporary impacts represent the time required for vegetation to reestablish where disturbance has occurred from placement of the pipeline and staging areas.

Direct construction impacts would occur from the placement of the pipeline in the ground and construction of the five remote pump stations and the Kittitas Terminal. Pipeline construction impacts on vegetation would occur within a designated 18.3 m (60-foot) construction corridor. Construction activities within the corridor would result in the removal of vegetation from digging and grading; trampling of shrub and herbaceous vegetation by vehicles, construction materials, and workcrews; and potential breaking or damaging branches of trees overhanging the corridor.

Construction impacts would also include the potential damaging effect of compacted soils from vehicle use. Compacted soils may damage root systems of shallowly rooted plants and restrict the infiltration of water into the soil.

Acreage of Plant Communities Affected. Total construction impacts on upland plant communities would be approximately 547 ha (1,353 acres), with the majority of impacts associated with clearing and grading 530 ha (1,310 acres) for the pipeline placement (Table 3.3-7). Approximately 15 ha (37 acres) of vegetation would be permanently removed by construction of the pump stations and Kittitas Terminal.

Table 3.3-7. Pipeline Construction Impact Area on Plant Communities Within the 60-Foot-Wide Construction Corridor

Cover Types	Impact Acreage
Western hemlock	38.6
Silver fir	1.0
Mountain hemlock	0.0
Douglas-fir	2.0
Ponderosa pine	2.2
Deciduous forest	4.9
Mixed forest	3.7
Young (regenerating) coniferous forest	51.9
Old-growth coniferous forest	0.0[a]
Scrub-shrub	207.6
Shrub-steppe	541.7
Grass/forb	10.6
Cropland	275.1[b]
Hay/pasture	150.1
Orchard	6.8[b]
Developed (vegetated)	13.8
Total	1,310.0

[a] The route avoids impacts to old-growth forest.
[b] Most impacts to agricultural land will occur prior to the growing season.

Source: OPL 1998.

Permanent impacts associated with the pump stations and the Kittitas Terminal include 2.8 ha (7 acres) of weedy grass and forb cover (with a small number of second- and third-growth conifer trees), and 12.1 ha (30 acres) of cropland. Directional drilling work areas at the Columbia River crossing would affect about 1.2 ha (2.9 acres) of shrub-steppe plant communities that have been degraded from previous development projects, including construction of the Wanapum Dam and installation of electrical transmission lines.

The pipeline construction impacts on plant communities within the 18.3 m (60-foot) construction corridor are shown in Table 3.3-7. Impacts on the different vegetation cover types along the 372 km (231-mile) corridor can be summarized as follows:

- Approximately 109 km (68 miles) of the pipeline corridor would impact communities in maintained BPA ROW or along abandoned railroad beds that are dominated primarily by scrub-shrub, young forest, or shrub-steppe vegetation.

- Approximately 217 km (135 miles) of the corridor would impact vegetation in areas where the construction corridor does not directly overlap with an existing road, trail, or maintained utility corridor. Within the 217 km (135 miles), impacts would occur on approximately 16 km (10 miles) of forest cover (including young regenerating forests in clearcut areas), 124 km (77 miles) of shrub-steppe, 64 km (40 miles) of agricultural land, and 13 km (8 miles) of the other miscellaneous plant communities.

- Vegetation impacts would not occur on approximately 45 km (28 miles) of the corridor where the pipeline follows existing trails or corridors and vegetation does not exist (Cedar Falls Trail, Homestead Valley Road, John Wayne Trail, Tinkham Road, and Snoqualmie Pass Tunnel).

The most substantial impacts would occur where new corridors are established in forested vegetation near streams, and on shrub-steppe vegetation. Cutting new corridors would result in the loss of forest in riparian areas at stream crossings such as the Tolt River, Griffin Creek, Tokul Creek, and Humpback Creek. Construction would result in the loss of the existing forest vegetation structure of overstory trees and understory vegetation in these areas. A permanent loss of forested conditions is considered a moderate impact near salmon-bearing streams and/or riparian areas. Revegetation would occur after construction, but a 9.1 m (30-foot) maintenance corridor would be maintained in scrub-shrub; trees would be planted outside this maintenance corridor.

Half of the 18.3 m (60-foot) construction corridor at all other forested areas along the construction corridor would be replanted with native forest vegetation after construction. However, there is still a minor impact because of the long time needed for the plantings to replace the existing forest condition. Revegetation efforts would be most successful in those areas with (1) sufficient topsoil, (2) soils with low percentage of cobbles and rocks, (3) not highly erosive conditions, and (4) absence of weeds in the surrounding area. Species that would be used for revegetation of eastern and western Washington forests are specified in the vegetation technical report (Dames & Moore 1997).

Approximately 218 ha (540 acres) of shrub-steppe would be disturbed. Although the majority of the shrub-steppe plant communities are somewhat degraded, approximately 26 percent of the shrub-steppe community impacted is dominated by native shrubs and grasses (Table 3.3-8). The disturbance of shrub-steppe communities dominated by native shrubs and grasses represents a moderate impact because restoring these communities is difficult and long term. Lost botanical resources would include the likely decrease in cover of native perennial grasses and the cryptogam crust. Exposure of soil on disturbed sites would create areas where cheatgrass and other non-native grasses could establish. Disturbance of the cryptogan crust could affect soil erosion. Impacts on soil and the related impacts of sedimentation on water quality are discussed in Sections 3.2 and 3.7.

Table 3.3-8. Pipeline Construction Impact Area on Shrub-Steppe Plant Communities Within the 60-Foot-Wide Construction Corridor

Plant Community	Impact Area (acres)	Percent of Total Impact Area
Communities Dominated by Native Shrubs and Grasses		
Sagebrush/native grasses	92.1	
Sagebrush/rabbitbrush/native grasses	27.3	
Native grasses	15.1	
Bitterbrush/rabbitbrush/native grasses	2.8	
Wildrye grass	3.9	
Subtotal	141.2	26%
Communities Dominated by Native Shrubs with Nonnative and Native Grasses		
Sagebrush/rabbitbrush/cheatgrass	47.5	
Buckwheat/native and nonnative grasses	10.8	
Bitterbrush/sagebrush/native and nonnative grasses	28.8	
Sagebrush/rabbitbrush/cheatgrass/native grasses	34.7	
Bitterbrush/native and nonnative grasses	42.3	
Sagebrush/cheatgrass/native grasses	81.3	
Rabbitbrush/buckwheat/native and nonnative grasses	5.0	
Cheatgrass	14.4	
Sagebrush/cheatgrass	70.0	
Rabbitbrush/cheatgrass	23.8	
Sagebrush/spiny hopsage/native and nonnative grasses	0.8	
Sagebrush/buckwheat/native and nonnativegrasses	25.5	
Greasewood/sagebrush/cheatgrass	7.1	
Greasewood/cheatgrass	0.7	
Subtotal	392.7	73%
Shrub-steppe unknown*	5.8	1%
Total	539.7	100%

Note: The total shrub-steppe impact in Table 3.3-7 is somewhat greater than the total area for detailed shrub-steppe community impacts shown above. This is due to the minimum mapping units between the two GIS coverages, which result in a cumulative difference of approximately 2 hectares (4.9 acres).

* Permission to access property denied.

Source: Plant communities and impact areas provided by OPL 1998.

Natural recovery times to reestablish a cryptogam crust on the shrub-steppe communities can be long term, 14 to 85 years, where crust has been heavily trampled or completely removed (Kaltenecker and Wicklow-Howard 1994).

To minimize the effects of the construction on shrub-steppe communities, OPL proposes to revegetate the construction corridor using a native seed mix that includes big sagebrush, stiff sagebrush, bluebunch wheatgrass, Sandberg's bluegrass, and Idaho fescue. The effectiveness of seeding native shrub-steppe vegetation would be limited by the aggressive growth of cheatgrass and other non-native species and dry soil conditions present in the shrub-steppe communities. The success of cheatgrass establishment on disturbed sites is apparently due to its winter root growth which gives it a spring and early summer advantage over native perennial grasses (Barbour 1980).

An Oregon white oak plant community is located near Swauk Creek east of Cle Elum in Kittitas County. Oregon white oak communities are considered a priority habitat by WDFW. The pipeline corridor would avoid cutting stands of this plant community, although a few individual trees could be removed during construction. The pipeline corridor would avoid most Oregon white oak stands and the removal of a few trees is considered a minor impact.

Impacts on aspen groves and talus slopes would be avoided because the pipeline corridor would not cross through these habitat types.

Impacts on the grass/forb, young regenerating forest, and developed (vegetated) plant communities are considered minor because:

- The impact area would be relatively small.

- Grass/forb and vegetated developed communities are composed primarily of non-native species along roads, vacant lots, and lawns.

- Disturbed areas would be revegetated with native or naturalized species that can be easily planted and maintained to preconstruction conditions (species used for revegetation are specified in the vegetation technical report, Dames & Moore 1997).

- The majority of the scrub-shrub plant community impacts would occur along the BPA ROW. Many of these scrub-shrub communities have been maintained in this condition by ROW maintenance activities and would be relatively easy to revegetate to these conditions. Scrub-shrub plant communities, however, are also associated with riparian areas in western and eastern Washington. Loss of riparian areas would be minimized along streams by replanting the corridor with native shrubs common to the affected site. A 3 m (10-foot) wide zone in riparian areas adjacent to streams would not be replanted to maintain a narrow corridor for visual inspection.

Impacts to vegetation would be avoided where the pipeline corridor utilizes an existing road or trail and no vegetation would be removed. Specialized construction equipment would be used so vegetation adjacent to the road or trail would not be cleared. Impacts would also be avoided by

using existing roads to access work areas. In addition, OPL would mark the edges of the 18.3 m (60-foot) construction zone with fencing to limit construction activities to the construction corridor.

For all upland communities to be restored, a 5-year monitoring program would be implemented. A monitoring plan would be developed that describes performance standards for plant cover and survivorship, percent cover allowable for invasive species, damage that may have occurred to existing vegetation along the construction corridor, erosion of topsoil, and other impacts. Contingency plans would also be included if revegetation efforts do not meet performance standards and measures are required to correct other impacts (e.g., damaged vegetation or erosion).

Threatened and Endangered Plant Species. No impacts on threatened, endangered, or candidate plant species are expected because no such species were identified during field surveys.

Sensitive Plant Species. Populations of sensitive plant species that would be lost during construction because they are located within the construction corridor include the following:

- one population of pauper milk-vetch (state sensitive species) in Kittitas County; and
- two populations of Piper's daisy (state sensitive) located in Grant County and one population in Adams County.

Although fewer than 100 plants would be lost, which represents a small percentage of the known number of these species in Washington, this impact is considered moderate because it contributes to the loss of state sensitive plant species. This impact could be eliminated or reduced by conducting additional field studies to reroute or narrow the construction corridor, and avoid the majority of Piper's daisy and pauper milk-vetch located along the corridor. (The two species are not USFS sensitive species.)

Survey and Manage Plant Species. Construction of the proposal is not expected to have any negative effect on survey and manage plant species because forest with old-growth characteristics, or habitat for plant species associated with old-growth forest or late-successional habitat, would not be affected. The no adverse effect conclusion for this proposed project is consistent with the USFS Northwest Forest Plan and the Snoqualmie Pass Adaptive Management Area Plan (USFS/USFWS 1997).

Approximately 0.2 ha (0.5 acre) of young second-growth conifer forest would be cut in an LSR land designation. The second-growth forest condition in the new corridor does not represent the specific old-growth habitat associations described for the lichen and fungi species in Table 3.3-6. However, until ecologists learn more about these species through additional field studies, it is presumed that survey and manage species could occur in areas other than old-growth forest. Field surveys were conducted for survey and manage plant species that are also listed as USFS sensitive plant species; these species were not found where the proposed route occurs in LSR designations.

The known occurrence of the fungus noble polypore would not be affected because the corridor primarily follows an existing road/railroad bed within the management area around the

fungus. The section of forest corridor to be cleared for the pipeline occurs in second-growth forest without the microsite habitat requirements where the fungus population could potentially expand.

The impact of constructing the pipeline through second-growth forest in the area of the noble polypore is not considered a significant impact because of (1) the small area of forest temporarily disturbed, and (2) the area to be impacted is dominated by plant species commonly found throughout the western Cascades. However, the impact of cutting vegetation in an LSR land-use designation is discussed in Section 3.12, Land Use.

Unique Communities. A high-quality, native shrub-steppe community dominated by sagebrush and native grasses with an intact cryptogam crust would be impacted by construction activities. Approximately 0.8 ha (2 acres) of this community type along the steep banks on the east side of the Columbia River would be affected. This is considered a moderate impact because of the rarity of this type of habitat in Washington.

Although the site would be revegetated with native shrub-steppe species after construction, restoration of disturbed shrub-steppe communities is difficult and long-term. Natural recovery times to reestablish the elements of a native shrub-steppe community (e.g., cryptogam crust and native shrubs and grasses) can be up to 85 years as previously mentioned. In addition, the disturbed site would create areas where invasive weeds could potentially grow and become a weed source.

Noxious Weeds. Plant species listed as noxious weeds could invade sites disturbed by construction activities. OPL would implement the following measures to reduce the impact of noxious weeds to a minor level:

- Check vehicle tires and undercarriages when entering or leaving a work site, knock and wash off mud and remove weeds, soil, seeds, and all vegetation material from vehicles; keep equipment clean and free of weeds and seed.

- Use weed-free certified straw bales instead of hay bales for erosion control to limit the number of weed seeds introduced to disturbed areas.

- Replant trees and shrubs in all appropriate disturbed areas outside the maintained corridor to shade out undesirable grasses and weeds.

- Use only noxious-weed-free seed and weed-free mulch for revegetation sites.

- Cooperate with the Washington Noxious Weed Control Board in designing and implementing other methods to control the spread or introduction of noxious weeds.

Operational Impacts. Operational impacts would be associated with the periodic removal of vegetation for maintenance of the line. In addition, there is a possibility of pipeline breaks and spills as discussed below.

Corridor Maintenance. Maintenance of the pipeline corridor would require the permanent removal of trees and some shrubs growing within a 9.1 m (30-foot) corridor. As

previously mentioned, a 3 m (10-foot) corridor would be maintained in riparian areas adjacent to streams. This would be done to allow visual inspection of the pipeline from the air and to prevent the roots of woody vegetation from damaging the pipe. Plant communities and area affected by the clearance are shown in Table 3.3-9.

Table 3.3-9. Operational Impact Area on Plant Communities Within the 30-Foot-Wide Maintenance Corridor

Cover Types	Impact Acreage
Western hemlock	21.1
Silver fir	1.0
Mountain hemlock	0.0
Douglas-fir	1.2
Ponderosa pine	1.1
Deciduous forest	3.3
Mixed forest	3.7
Young (regenerating) coniferous forest	27.9
Old-growth forest	0.0
Scrub-shrub	105.1
Shrub-steppe	0.0
Orchard	3.0
Developed (vegetated)	6.6
Total	174.0

Source: OPL 1998.

Vegetation clearing along the pipeline would be done by cutting vegetation with mechanical mowers and tree trimmers. EPA-approved herbicides may be used for weed control within the pump station areas owned and maintained by OPL. Because of the methods used for weed control, no impacts from herbicides would affect sensitive resource areas such as riparian zones, wetlands, sensitive plant and animal locations, recreation use areas, and urban areas.

Vegetation removed from the construction corridor during construction or maintenance would be disposed of per the request of the specific landowner in a manner consistent with state and federal requirements. Options for disposal could consist of burning, hauling to a dump site approved for vegetation material, or stacking onsite. Burning would require acquiring appropriate state and federal permits and would be subject to timing restrictions to reduce fire hazard and local air quality degradation.

Plant communities not affected by the maintenance clearing would be herbaceous plant communities, agricultural land, developed land, and shrub-steppe vegetation. These areas would be allowed to regrow naturally once the pipeline is installed.

Maintenance of 9.1 m (30-foot) wide visual corridor would result in (1) the permanent loss of approximately 66.5 ha (164 acres) of forested and scrub-shrub vegetation where native plant species occur, and (2) the permanent removal of riparian vegetation along streams (see Section 3.6, Water and Section 3.7, Fisheries). Although the vegetation removal represents a permanent loss, it would occur within the scrub-shrub plant community along the BPA corridor and in second-growth or young regenerating forest plantations. This represents a minor impact.

Spills. Potential impacts resulting from a spill are difficult to determine because the location and extent of a potential spill are unpredictable, except in terms of risk (see Appendix A, Spill Risk Information, and Section 3.18, Health and Safety). However, all plants are vulnerable to the effects of a product spill. Effects on vegetation would depend on whether a spray or high-volume point spill occurred.

Low-volume sprays or spills that contact foliage and move quickly over the soil surface (and do not penetrate the soil surface into the root zone) would likely have a toxic effect on herbaceous plants. Leaves and young shoots of trees and shrubs could also be killed by a spray.

High-volume spills that are distributed over the soil surface and penetrate the root zone would likely kill trees and shrubs that are shallowly rooted. Regrowth of woody species would depend on whether the entire root system was killed or if plants such as willow and alder could resprout from remaining root material. Recovery times from areas subject to a high-volume spill would depend on (1) the ability of desirable species to revegetate the site after the product in the soil has degraded to less than toxic concentrations, and (2) the type of plant community affected. Forested and shrub communities would require longer to reestablish the tree and shrub canopies compared to the reestablishment of an herbaceous community.

Over time, there is a substantial reduction in the concentrations of fuel spilled in soils after the spill occurs (Green et al. 1996, Piotrowski et al. 1992). The recovery time depends upon the concentrations in the soil. Study of a diesel fuel spill effects on herbaceous and shrub vegetation at an Alaskan air force station over two successive growing seasons after the pipeline ruptured showed significant reductions in concentration of spilled fuel were achieved and appreciable regrowth of the vegetation was observed in the affected areas (Piotrowski et al. 1992). However, research on the effects of crude oil spills indicates recovery of herbaceous and conifer vegetation can take several years and longer (Clark and Ward 1994, Collins et al. 1994). The proposed line would contain products that are heavier than the light aromatics present in crude, yet much lighter than the tar residuals remaining after a crude oil spill. Thus, short-term toxicity of a product spill might be similar to crude while longer term toxicity of product near the surface would be less, due to evaporation and degradation. Implementation of the spill recovery plan would reduce impacts on vegetation.

An oil spill from the line which leaves the corridor ROW could affect unique, sensitive, or threatened and endangered plant species. A location for such a spill cannot be predicted. The probability of such a spill is discussed in Section 3.18.

Threatened and Endangered Plant Species. No impacts are expected to occur from routine operation of the line because no federally listed threatened, endangered, or candidate plant species were found within the construction corridor.

Sensitive and Survey and Manage Plant Species. Operational impacts are not expected for sensitive plant species or survey and manage plant species. Survey and manage plant species are located approximately 0.04 to 0.8 km (0.01 to 0.5 mile) away from the operational ROW and would not be affected by operational activities.

Sensitive plants located in the shrub-steppe plant communities that were avoided during construction would also be avoided during any maintenance operations along the corridor. Additionally, shrub-steppe vegetation would not be removed to conduct inspections, and therefore no operational impacts would occur on sensitive plants in the shrub-steppe plant communities.

Unique Communities. The long-term impacts of reestablishing native shrub-steppe plant communities are discussed above under construction-related impacts. Although the operational activities would not occur along the portion of the high-quality native shrub-steppe community located east of the Columbia River, the disturbed nature of the site would encourage the invasion of noxious weeds and other undesirable non-native plant species.

Noxious Weeds. OPL would cooperate with the Washington State Noxious Weed Control Board, local county noxious weed representatives, and the USFS (if activities occur on federal lands) to identify specific means to control noxious weed infestations. Control methods would incorporate an integrated vegetation management approach where a combination of mechanical, biological, or chemical methods would be used to eradicate noxious weeds.

Columbia River Approach Options. The option south of I-90 through the YTC and west of the proposed route (as the route turns south to cross the Columbia River) would impact 3.8 ha (9.5 acres) of shrub-steppe vegetation more than the proposal (north of I-90 and south to cross the Columbia). Therefore, this option would have a slightly greater impact on this vegetation type. Shrub-steppe vegetation south of I-90 is used for military exercises in the YTC and livestock grazing. It is dominated by big sagebrush, bitterbrush, and a mix of native and non-native grasses.

This option south of I-90 would also impact an additional 1.6 ha (3.9 acres) of hay/pasture and 1.3 ha (3.3 acres) of grass/forb communities more than the proposed route (north of I-90). Placing the route inside the fence line of the YTC and closer to I-90 would result in similar impacts on shrub-steppe vegetation as this alternative.

Impacts on sensitive plant species would be greater for the alternative south of I-90 and through the YTC than for the proposed pipeline corridor. Two populations of Hoover's tauschia located during field surveys along an alternative route through the YTC would be impacted. Two populations of Hoover's tauschia identified by a WNHP rare plant inventory as being located on the YTC (Salstrom et al. 1995) would be avoided by a segment option that runs closer to the fence line.

No threatened and endangered plant species or plant communities meeting the criteria as unique communities would be affected by the segment options through the YTC.

Columbia River Crossing Options. A segment option that crosses the Columbia River using the Burlington Northern Beverly Railroad Bridge would impact 17 ha (42 acres) of shrub-steppe vegetation more than the proposed crossing below the Wanapum Dam. This assumes the

railroad bridge alternative crossing would extend south from the proposed route along the Columbia River to the bridge. Shrub-steppe vegetation in this area is used for livestock grazing and is dominated by big sagebrush, bitterbrush, rabbitbrush, cheatgrass, and some native grasses.

Impacts on sensitive plant species by using the Burlington Northern Beverly Railroad Bridge crossing option could be greater than for the proposed route. Two populations of desert evening primrose, a state sensitive species, are located along the railroad bridge crossing alternative route. Columbia milk-vetch, a state threatened species, occurs along alternative segments for approaching a southern crossing of the Columbia River. The impacts could be avoided by narrowing the construction corridor between the desert evening primrose populations to leave the populations undisturbed by construction activities, and avoiding those alternative segments where the Columbia milk-vetch occurs.

No threatened and endangered plant species, or plant communities meeting the criteria as unique communities, would be affected by the segment options.

Vegetation impacts related to crossing of the Columbia River at the I-90 Bridge and a wet trench crossing north of the I-90 Bridge would be slightly greater than those described for the proposed route. The wet trench crossing would impact an additional 6.0 ha (14.9 acres) of shrub-steppe vegetation and 4.9 ha (11.6 acres) of cropland, hay/pasture, and grass-forb vegetation than the proposed route. The I-90 Bridge crossing would impact only an additional 1.1 ha (2.6 acres) of shrub-steppe vegetation and 1.8 ha (4.4 acres) of cropland and hay/pasture than the proposed action.

Cumulative Impacts. Construction of the project would not significantly contribute to the permanent loss of natural vegetation communities in Washington. The majority of impacts would be temporary because revegetation would occur on the proposed route. However, 15 ha (37 acres) of weedy cover and degraded shrub-steppe would be permanently lost from the construction of pump stations and terminal facilities. In addition, approximately 67 ha (164 acres) of forested and scrub-shrub vegetation cover would be permanently lost from maintaining a 9.1 m (30-foot-wide) maintenance corridor along the proposed route.

Construction of the pipeline would contribute to the decline of shrub-steppe habitat conditions. Approximately 57 ha (141 acres) of shrub-steppe communities dominated by native grasses and shrubs in eastern Washington would be disturbed by project construction. The amount of shrub-steppe communities with native species as dominants is approximately 5 percent of its historic extent in the state based on estimates by the Washington Natural Heritage Program. The difficulty in restoring shrub-steppe communities after pipeline construction could contribute to the overall loss of higher quality shrub-steppe vegetation.

Cumulative vegetation impacts could happen if other actions along the alignment were just completed or begin just before or after the OPL line is built. Revegetation activities in a state of recovery could be destroyed. Routine vegetation management and other ROW maintenance would occur along existing ROW in addition to OPL maintenance. Mechanical activities such as vehicle use, human access, and vegetation cutting are minor impacts and routine. Herbicide application, however, could be cumulative if applied by each party along their own ROW. In general, OPL would minimize herbicide use in favor of mechanical clearing. If herbicides are to be used, OPL should develop a

vegetation management plan which recognizes the activities of other ROW partners and does not contribute to additional chemical impacts.

3.3.2.2 No Action

Under the No Action Alternative, impacts from the proposal would not occur, although operational impacts from the existing system would continue. Vegetation along freeways and other roadways would be exposed to trucks that could spill product from the tanks onto roadside vegetation, and the risk would increase slightly each year as more trucks continue to use the roadways for delivery. No terrestrial impacts would occur from barge operation or barge spill.

3.3.3 Additional Proposed Mitigation Measures

3.3.3.1 Construction Mitigation and Subsequent Impacts

Additional mitigation measures that OPL should implement are as follows:

- Ensure the existing occurrence of noble polypore is not affected by the construction activities and no impacts occur to the species. A biologist familiar with the species should be present during construction to ensure construction activity does not occur beyond the designated construction limits, to reduce the possibility of inadvertently damaging the species or nearby potential habitat.

- Ensure noxious weed infestations remain a minor impact by conducting a post-construction weed inventory 1 year after construction to determine the extent to which noxious weeds may have invaded disturbed areas. Develop and implement a noxious weed control plan approved by the state and local county noxious weed control boards. The plan would address short-term (1-year post-construction) and ongoing long-term methods to control noxious weeds, monitoring methods, criteria to determine if noxious weeds are becoming a problem, and contingency plans to treat infestations of noxious weeds.

- Salvage and stockpile topsoil at all vegetation communities in separate stockpiles from subsoil. Replace the topsoil in its original position in the soil profile. This will help ensure impacts on vegetation communities remain at minor or moderate impact levels as previously discussed.

- Fence locations of sensitive plants that are to be avoided and use an onsite biological monitor at those locations during construction activities to ensure sensitive plants are not disturbed and no impacts on sensitive plants occur.

- Avoid Oregon white oak trees where possible. If trees are cut, replace trees removed during construction with trees propagated from acorns collected onsite at a 2:1 ratio of

those trees cut along the pipeline corridor. Planting would occur outside of the 9.1 m (30-foot) maintenance corridor. Revegetation of oak trees would reduce the minor impact to a negligible impact.

- Include bitterbrush in the shrub-steppe seed mix where the species is part of the natural community which would be disturbed. Shrub-steppe impacts would remain a moderate impact because of the difficulty in restoring this plant community and time lag in restoring to pre-construction conditions. Include an onsite seed collection program and propagate container-grown plants to plant in those portions of the shrub-steppe communities that are high-quality, native plant communities.

- Before ground disturbance begins, prepare a revegetation plan that specifies plant material size, planting densities, planting methods, seed mixes, application rates, timing of planting, and seed application. Include willow wattling as a revegetation technique on those riparian areas where revegetation could help stabilize streambanks and reduce erosion. Monitor the revegetation plantings to ensure the revegetation plan is implemented as designed.

- Prepare a contingency plan before construction begins that addresses revegetation performance standards and measures to be taken if standards are not achieved.

- The revegetation and contingency plans would be reviewed and approved by the USFS, BLM, EFSEC, and other state and federal agency whose lands owned by those agencies would be affected by the pipeline.

3.3.3.2 Operational Mitigation and Subsequent Impacts

No additional operational mitigation measures are recommended.

3.4 WETLANDS

3.4.1 Affected Environment

This section presents information related to wetlands along the pipeline corridor. Unless otherwise noted, information presented in this section is based on field surveys, the ASC (OPL 1998), and the wetland report prepared for this proposal (Dames & Moore 1997). A detailed analysis of the conditions of each wetland and impacts is presented in the ASC.

The scientific names of plant species used in this section are provided in Table 3.4-1. For ease of reading, only common plant names are used in text.

Table 3.4-1. Common and Scientific Names of Plant Species Mentioned in Section 3.4, Wetlands

Common Name	Scientific Name
black cottonwood	*Populus trichocarpa*
common bullrush	*Scirpus acutus*
common cattail	*Typha latifolia*
Douglas' spirea	*Spiraea douglasii*
hairy willow-herb	*Epilobium ciliatum*
red alder	*Alnus rubra*
red-osier dogwood	*Cornus stolonifera*
reed canarygrass	*Phalaris arundinacea*
Russian olive	*Elaeagnus angustifola*
salmonberry	*Rubus spectabilis*
saltgrass	*Distichlis spicata*
sedges	*Carex* spp.
soft rush	*Juncus effusus*
western red cedar	*Thuja plicata*
willow	*Salix* spp.

3.4.1.1 Wetland Numbers, Location, and Size

Wetlands are important natural communities that have been documented along the pipeline corridor because of federal, state, and local laws and policies that pertain to their protection.

Wetlands are protected because of historic and current statewide losses of this habitat. The regulatory definition of wetlands is as follows:

> areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (33 CFR 328.3, 40 CFR 230.3).

Under Section 404 of the Clean Water Act, the U.S. Army Corps of Engineers (ACOE) and U.S. Environmental Protection Agency (EPA) regulate the placement of dredge or fill material into waters of the United States. Such waters include surface water features such as wetlands, intermittent and perennial streams, rivers, ponds, lakes, and wet meadows. Streams and rivers are discussed in Section 3.6, Water and Section 3.7, Fisheries.

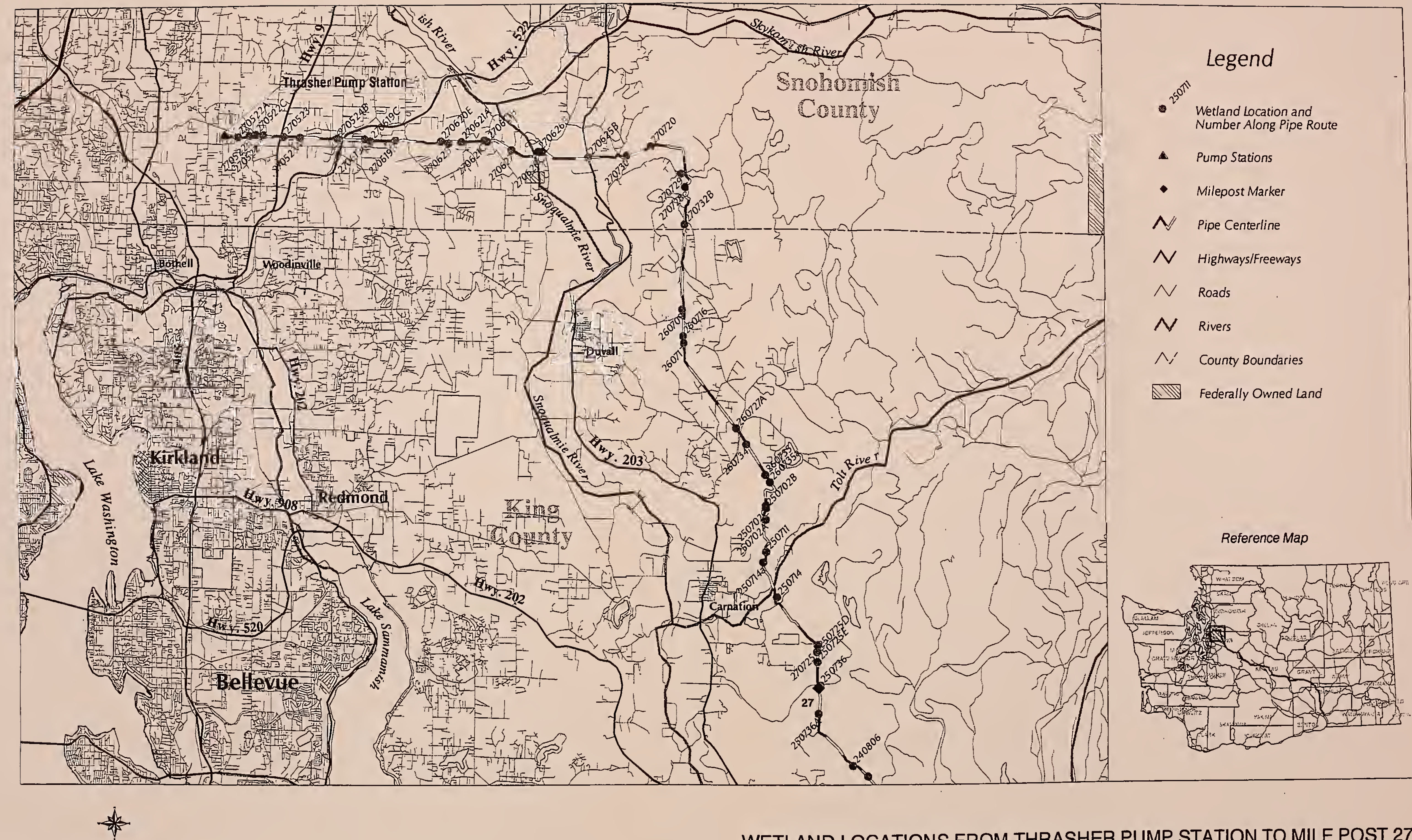
Although the Clean Water Act protects wetlands, filling of wetlands may occur under the Act and only by authorization of the ACOE. Projects that will involve filling wetlands or other water bodies require a Section 404 permit from the ACOE before filling can occur. The ACOE also considers excavation and mechanized land clearing in wetlands as regulated activities. Section 10 of the Rivers and Harbors Act of 1899 also regulates activities that occur in navigable waters such as the Columbia River.

Wetlands along the pipeline corridor were identified by reviewing aerial photographs, National Wetland Inventory Maps, and local agency wetland maps, and by conducting field surveys along the corridor, pump stations, terminal facility, and alternative Columbia River and YTC segments. Wetlands were field delineated by OPL using the 1987 ACOE Wetlands Delineation Manual. Wetland maps showing boundaries of all wetlands impacted by the construction corridor have been submitted to the ACOE.

A total of 137 wetlands were identified within the 61 m (200-foot) study corridor centered on the pipeline corridor (Figures 3.4-1 and 3.4-2). The pipeline would cross 78 of these wetlands within the 9.1 m (30-foot) construction corridor. (The construction corridor would be narrowed to 9.1 m [30 feet] in wetlands, instead of the 18.3 m [60-foot] construction corridor used for other areas, to minimize potential wetland impacts.)

Wetland numbers used in this EIS correspond to those in the wetland report (Dames & Moore 1997). Wetlands were numbered in the wetland report according to the township, range, and section in which they are located. For example, a wetland located in Township 18 North, Range 12 East, Section 21 would be numbered 181221. Wetland maps showing the configurations and locations of each wetland affected by the proposal are presented in the wetland report on 1 inch = 250 feet aerial photographs (Dames & Moore 1997).

The 78 wetlands affected by the project encompass an area of approximately 284 ha (702 acres) and range in size from less than 1 ha to over 40 ha (100 acres). Wetland vegetation classes within the construction corridor include palustrine emergent, scrub-shrub, and forested wetlands as defined by Cowardin et al. (1979). Some riverine and open water areas totaling 0.3 ha (0.7 acre) are included within the wetland boundaries. Appendix B summarizes the size, vegetation

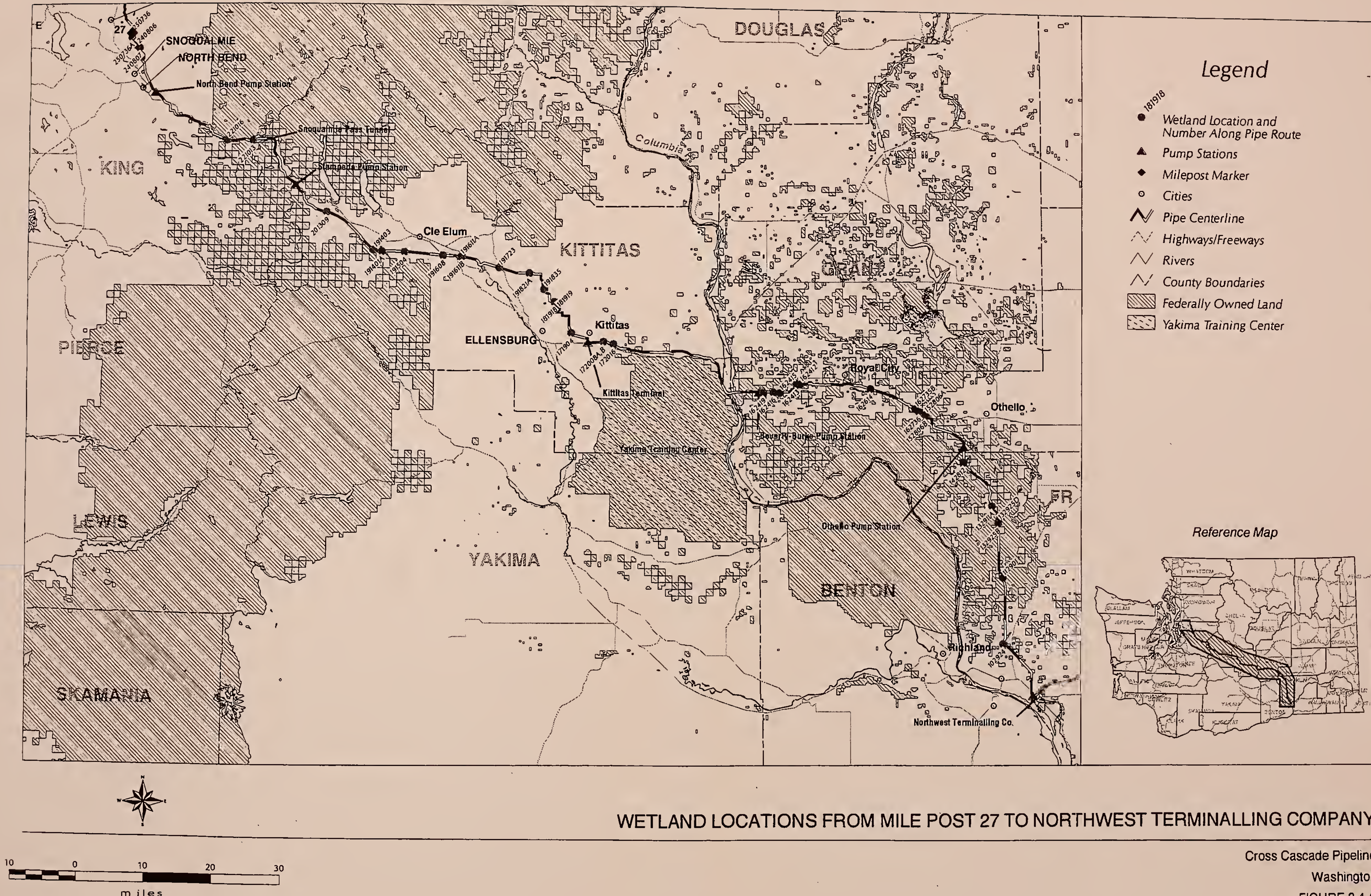


WETLAND LOCATIONS FROM THRASHER PUMP STATION TO MILE POST 27

Cross Cascade Pipeline

Washington

FIGURE 3.4-1



WETLAND LOCATIONS FROM MILE POST 27 TO NORTHWEST TERMINALLING COMPANY

Cross Cascade Pipeline

Washington

FIGURE 3.4-2

classes, dominant plant species, and categories for 72 of the 78 wetlands within the construction corridor (based on Ecology's [1991, 1993] four-tiered rating systems for eastern and western Washington). (Information for 6 of the 78 affected wetlands was not available at the time of printing this Draft EIS.)

3.4.1.2 Wetland Conditions and Resource Rating

Conditions of wetlands are typically described by discussing the wetland vegetation, soil, hydrology, and functions. Because of the numerous wetlands located along the pipeline corridor, it is impractical to discuss the characteristics of each wetland in the EIS. However, the specific conditions for the majority of the wetlands are presented in OPL's wetland report (Dames & Moore 1997). The wetland report describes the dominant plant species found in each wetland, soil types and characteristics, and hydrologic conditions (e.g., seasonal or perennial saturation or inundation; whether the source of water to the wetland is associated with a stream, surface runoff, or high groundwater; and field characteristics that indicate wetland hydrology is present). Functions associated with each wetland are also discussed in the report.

The wetlands along the pipeline corridor in western and eastern Washington include isolated wetlands (i.e., wetlands not part of a surface tributary system) and wetlands associated with surface water features. Some of the larger creeks and streams where wetlands are found include wetlands associated with Bear Creek in Snohomish County; Cherry Creek, Harris Creek, and Griffin Creek in King County; Cabin Creek and Swauk Creek in Kittitas County; Crab Creek in Grant County; and Eagle Lake in Franklin County.

Resource Rating Definitions. Washington's wetland resource values can be evaluated using the Washington Department of Ecology's wetland rating systems for western and eastern Washington (Ecology 1991). The wetlands rating system ranks wetlands as Category I, II, III, or IV using a variety of factors such as habitat characteristics, vegetation patterns, species diversity, size, wildlife habitat use, degree of disturbance, and connectivity to other resources:

- Category I wetlands are considered to be of the highest resource value. Category I wetlands can include large forested wetlands, and wetlands with habitat for federal or state listed threatened and endangered species.
- Category II wetlands contain important habitat characteristics or habitat for state priority fish and wildlife species, can provide very high function for wildlife species, and are more common than Category I wetlands. Category II wetlands can be larger than many Category III and IV wetlands.
- Category III wetlands can provide important functions and values and are important for a variety of wildlife species. Generally these wetlands occur more commonly than Category I and II wetlands; they are smaller, less diverse, and/or more isolated in the landscape than Category II wetlands.

- Category IV wetlands are generally the smallest and least diverse in habitat structure and plant species than Category I, II, and III wetlands but still provide some function or value commonly attributed to wetlands.

Table 3.4-2 summarizes the number of wetlands along the pipeline corridor in western and eastern Washington by category.

Table 3.4-2. Number of Wetlands within the 30-Foot Construction Corridor by Category in Eastern and Western Washington

	Category I	Category II	Category III	Category IV	Total
Western Washington	26	8	10	1	45
Eastern Washington	5	18	10	0	33
Total	31	26	20	1	78

Source: Dames & Moore 1997 and other information provided by Dames & Moore.

Category I Wetlands along Pipeline Corridor. The 26 Category I wetlands in western Washington received this rating because some portion of the wetland contains forested habitat greater than 0.4 ha (1 acre) in size, or state priority species or their habitats occur in these wetlands (e.g., osprey and pileated woodpecker). No wetlands that are considered bogs or wetlands in alpine or subalpine settings are located in the construction corridor.

Five Category I wetlands are located along the pipeline corridor in eastern Washington. One of the wetlands located in Kittitas County (Wetland No. 201309) is a forested wetland dominated by western red cedar and red alder. The other Category I wetlands are emergent wetlands associated with the Crab Creek drainage in Grant and Adams Counties. They are considered Category I wetlands because of the presence of anadromous fish in the associated streams and sandhill crane, a state endangered upland bird, in the region.

Although the pipeline corridor crosses 26 Category I wetlands in western Washington, the portion of the wetlands where the corridor would be located is within the BPA ROW in 23 of those wetlands. A USFS road crosses through two of the other Category I wetlands. In these cases, the vegetation has already been affected by ROW and road maintenance, and the quality and condition of the wetlands have previously been altered. Where the pipeline corridor crosses, these wetlands are dominated by scrub-shrub or emergent vegetation. Wetland plants along these ROW corridors are common species such as salmonberry, spiraea, red alder, willow, soft rush, cattail, and reed canarygrass. The forested portion of the Category I wetland located in Kittitas County occurs within the 61 m (200-foot) study corridor but not the 9.1 m (30-foot) construction corridor. The pipeline corridor utilizes the edge of the John Wayne Trail and avoids the forested portion of the wetland.

A Category I wetland near the Tolt River (Wetland No. 250714) in western Washington is a forested wetland located outside of existing maintained corridors. This wetland is dominated by western red cedar, red alder, and black cottonwood.

Category II Wetlands along Pipeline Corridor. Category II wetlands are the most common wetlands in the study corridor in eastern Washington. They are primarily scrub-shrub or emergent wetlands associated with intermittent or perennial creeks with sufficient habitat structure and species diversity to meet Ecology's Category II rating. Scrub-shrub wetlands are dominated by shrubs and small trees that are less than 6.1 m (20 feet) tall; emergent wetlands are dominated by herbaceous plants such as grasses, sedges, rushes, and forbs. Common plant species include reed canarygrass, sedges, soft rush, cattail, hairy willow-herb, red alder, willow, and Russian olive.

Category III and IV Wetlands along Pipeline Corridor. The 10 Category III and one Category IV wetland in western Washington received this Ecology rating because these are generally small wetlands (less than 0.8 ha [2 acres]) with low habitat diversity and vegetation structural diversity. The Category III and IV wetlands are scrub-shrub wetlands (plus one emergent wetland) dominated by species commonly found in wetlands of western Washington such as red alder, salmonberry, Douglas spirea, and soft rush.

Category III wetlands in eastern Washington include eight emergent wetlands and two scrub-shrub wetlands that are small (0.4 to 2 ha [1 to 5 acres]) with low to moderate habitat diversity, vegetation structure diversity, and plant diversity. The emergent wetlands are dominated by various herbaceous species which include cattail, common bulrush, saltgrass, and reed canarygrass.

Wetland Functions and Values. Functions and values of 72 of the wetlands within the construction corridor are discussed in the wetland report (Dames & Moore 1997). Functions and values presented in the wetland report include water quality, floodflow moderation, biological support, groundwater recharge/discharge, and recreation:

- Water quality functions were most commonly rated moderate to high for larger wetlands with herbaceous cover that can act as a sediment filter or capture pollutants from urban or agricultural runoff.

- Floodflow moderation was rated moderate to high for wetlands in a floodplain.

- Biological support was rated moderate to high for the Category I wetlands with several vegetation classes.

- Groundwater recharge and discharge functions were generally rated moderate.

- Recreation values were generally rated moderate to low because of the inaccessibility of many of the wetlands.

3.4.2 Environmental Consequences

3.4.2.1 Proposed Petroleum Product Pipeline

Construction Impacts - Overall Proposal. Direct, temporary construction impacts would occur within the 9.1 m (30-foot) construction corridor from placement of the pipeline in the ground, movement of heavy equipment through the wetland, temporary storage of backfill soil, and pulling of pipes through the wetland. This is expected to result in the temporary loss of vegetation and other habitat features such as stumps, downed logs, and snags. Soil disturbance from these activities and digging the trench could injure or kill plants if large portions of the plants' roots or aboveground shoots are cut or damaged. Indirect impacts could occur within the 9.1 m (30-foot) construction corridor or away from the corridor through water quality degradation, sedimentation, introduction of invasive species, and changes in wetland hydrology. These impacts would be reduced to a minor level of impact by implementing the BMPs presented in Appendix C and mitigation measures described in this section.

No impacts would occur from the construction of a building or facility in a wetland that result in a net loss of wetland acreage. However, permanent wetland impacts would occur where the pipeline is placed in a forested wetland, and the forest cover is removed and permanently maintained in a scrub-shrub or emergent vegetation class. Wetland functions would be compensated over time by restoring wetland areas temporarily impacted during pipeline construction and enhancing existing degraded wetlands (as discussed below).

Number and Area of Wetlands Impacted. Of the 137 wetlands within the 61 m (200-foot) study corridor, 59 would not be affected by construction activities. Portions of the other 78 wetlands are within the 9.1 m (30-foot) construction corridor. Approximately 6.9 ha (17.1 acres) of these wetlands would be directly impacted along the 372 km (231-mile) corridor (Table 3.4-3). See Appendix B for the impact area and vegetation class associated with most of the wetlands. The

Table 3.4-3. Summary of Area of Impact by Wetland Vegetation Class and by County (in acres)

County	Palustrine Forest	Palustrine Scrub-Shrub	Palustrine Emergent	Riverine	Palustrine Open Water	Total Impact
Snohomish County	0.03	3.88	1.31	0.02	0.12	5.36
King County	0.51	5.02	0.09	0.03	0	5.65
Kittitas County	0	1.36	1.96	0.02	0	3.34
Grant County	0	0	1.13	0.03	0.24	1.40
Adams County	0	0	0.07	0	0.21	0.28
Franklin County	0	0.71	0.30	0.03	0	1.04
Total	0.54	10.97	4.86	0.13	0.57	17.07

Source: OPL 1998.

78 wetlands impacted within the construction corridor cover a total of approximately 284 ha (702 acres); therefore, the 6.9 ha of wetland that would be impacted by pipeline construction represents approximately 2 percent of the total area covered by these 78 wetlands.

Other construction impacts that would occur in wetlands would include boring of the pipeline under four roads that are adjacent to wetlands: Maltby Road (Wetland No. 270522A), State Route 203 (Wetland No. 270625B), Lake Fontel Road (Wetland No. 270729), and Kelly Road (Wetland No. 260727A). The construction activities associated with the drilling would occur within the 9.1 m (30-foot) construction corridor and would not increase the footprint of construction impacts in the wetlands. Effects of boring on wetland hydrology are discussed below under "Hydrology Impacts".

Wetland Impact Avoidance and Minimization. NEPA guidelines prioritize mitigation to first reduce impacts through avoidance and minimization, and then rectify and compensate for unavoidable impacts. Selection criteria to identify the proposed route included utilization of existing roads, trails, and transmission line corridors to avoid wetland impacts. Following field studies, additional wetland impacts were avoided by realignment of the route where feasible. Feasibility includes consideration of land ownership and acquisition of easements, construction costs, reducing sharp angles and bends in the pipeline corridor, and access. Within the 61 m (200-foot) study corridor, 137 wetlands were identified and 59 of those wetlands were avoided by the proposed route. The proposed route would avoid approximately 277 ha (685 acres) of the 284 ha (702 acres) of wetland in the construction corridor. Additional wetlands may be avoided when the final alignment design is completed.

Forested wetlands, which are a more difficult type of wetland to compensate for through restoration or creation, have been largely avoided. There is 0.22 ha (0.54 acre) of impact along the 372 km (231-mile) route. For example, potential impacts on two wetlands (Nos. 240806 and 240807) in King County would occur where the pipeline corridor follows a road through the forested wetlands. However, most of the potential impact at these two wetlands has been minimized by using the unvegetated road surface.

Wetland impacts are further avoided by narrowing the construction corridor from 18.3 m (60 feet) to 9.1 m (30 feet) within the wetlands, placing staging areas for construction and pipe fitting in upland areas, and crossing the narrowest portion of the wetlands where feasible.

To minimize impacts on wetlands, the proposal would include mitigation measures identified in this chapter and Appendix C.

Vegetation Impacts. Vegetation impacts from construction would include clearing shrubs, trees, and herbaceous vegetation from wetlands. Vegetation within the construction corridor would be cut and removed, leaving roots intact where possible. Pulling of tree stumps and other rooted vegetation would occur within the open trench and other places within the construction corridor where they interfere with construction activities. The area of impact for forested, scrub-shrub, and emergent vegetation is shown in Table 3.4-3. This impact is considered minor because the vegetation removed for construction would be replanted with native wetland species common to the wetlands. The majority of the highest category wetlands in western Washington are located in the

BPA ROW, which is maintained in a scrub-shrub or emergent wetland condition. Plant species in this portion of the wetland, such as Douglas' spiraea, salmonberry, cattail, and soft rush, can easily be reestablished through revegetation.

Minor impacts on forested vegetation would occur at four wetlands and total 0.22 ha (0.54 acre). This impact is considered minor because:

- Although the dominant vegetation of the wetland would change, no loss of wetland acreage would occur. The proposal includes restoring the disturbed area to a scrub-shrub or emergent vegetated community (to allow for pipeline inspections) and enhancing degraded emergent wetlands to forested wetland in an amount equal to twice the disturbed area.

- The forested impact area within Wetland No. 270729 in Snohomish County would be 0.01 ha (0.03 acre) and would occur adjacent to existing cleared forested buffer areas at the narrow end of the wetland.

- Impacts on two of the wetlands (Nos. 240806 and 240807) in King County would occur where the pipeline corridor follows a USFS road through the wetland. Within the 0.14 ha (0.34 acre) wetland impact area identified for these two wetlands, most of the impact area is associated with the unvegetated road surface. Some forest wetland vegetation would be impacted where the road is not wide enough for the construction corridor.

The greatest impacts would occur at the forested wetland near the Tolt River in King County where the pipeline creates a new corridor and 0.07 ha (0.17 acre) of red alder and western red cedar forested wetland would be removed.

Directional drilling under four roads would affect a forested and three scrub-shrub wetlands. Wetland No. 270729 is a forested wetland and the boring entry site, and trenching, would affect 0.01 ha (0.03 acre) of red alder and western red cedar trees. Dominant plant species in the three scrub-shrub wetlands include salmonberry, spiraea, and red-osier dogwood. As previously discussed under "Number and Area of Wetlands Impacted", the directional drilling staging areas would occur within the 9.1 m (30-foot) construction corridor. Therefore, the impact area associated with this activity is already considered in the wetland impact area calculations along the proposed route.

Vegetation impacts that result from trenching or drilling in all scrub-shrub and emergent wetlands would be minimized by restoring these communities to their pre-construction plant cover and condition. Although many of the wetlands crossed are considered high quality because of the Category I or II rating, the construction corridor in most of these wetlands would be located in a previously impacted community. Plant communities in the wetlands have been altered by tree removal and/or agricultural practices in 75 of the 78 wetlands. As presented in the ASC, OPL would restore these wetlands after pipeline construction by separately stockpiling subsoil and topsoil and replanting with native species common to the wetland. Habitat values associated with large woody debris would be compensated by replacing downed logs greater than 12 inches in diameter and large root wads that may have been moved in the construction corridor during construction. Snags would be replaced by creating new snags in adjacent wetlands.

Wetland restoration and compensation goals would focus on addressing the impacts of the project. The project would result primarily in a temporary impact and, in forested wetland conditions, permanent loss of functions, but not in a loss of wetland acreage. Therefore, the goals of the restoration and compensation would be oriented towards replacing wetland functions. Wetland functions impacted by construction (trenching and boring) would be replaced by restoring onsite wetlands and enhancing other degraded wetlands located at four sites near the pipeline route in Snohomish, King, Kittitas, and Grant Counties. Enhancement of low-value wetlands would include:

- 4.5 ha (11.0 acres) of degraded emergent wetlands would be enhanced to scrub-shrub conditions;
- 1.0 ha (2.4 acres) of degraded emergent wetland would be enhanced as higher quality emergent wetland by planting native emergent vegetation; and
- 0.4 ha (1.1 acres) of degraded emergent wetland would be enhanced to forested wetland conditions.

This additional enhancement is proposed to help compensate for the loss of wetland functions during the time it takes for restoring the impacted wetlands to pre-construction conditions. A total of 5.9 ha (14.5 acres) of wetland would be enhanced in addition to restoring the 6.9 ha (17.1 acres) of wetland impacted along the pipeline corridor.

To ensure restoration and enhancement are successful, a 5-year monitoring program would be implemented by OPL as part of the proposal. Additional plant replacement through enhancement or restoration would be required where restored areas along the pipeline do not meet the following success standard: native herbaceous (for emergent wetlands) and woody cover (for scrub-shrub and forested wetlands) is at least 80 percent of the total plant cover; total cover is at least 80 percent of the wetland area; and the number of native plant species present in the restored or enhanced wetland is at least 50 percent of the number of species present before the restoration or enhancement occurred. Additional replacement through enhancement or restoration would be required for areas that do not meet the performance standards by enhancing or restoring additional amounts of forested, scrub-shrub, and emergent wetlands.

Wetland buffer impacts would be minimized by revegetating the buffer with vegetation similar to that found at the time of construction. Of the 78 wetlands impacted, 73 have buffers that are not forested within the construction corridor because the pipeline would follow existing corridors, roads, trails, and agricultural areas. For the remaining five wetlands with forest cover in all or part of the buffers, buffers would be planted with trees and shrubs. A 9.1 m (30-foot) maintenance corridor would remove approximately 1 to 2 percent of the total existing forested buffer area around the wetlands. This is considered a minor impact because of the small area of buffer affected, and the buffer would be replanted with native shrubs to provide for some of the same functions a forested buffer provides.

Hydrology Impacts. The wetland report discusses potential risks of creating a hydrologic change by trenching through wetlands (Dames & Moore 1997). At wetland crossings,

the pipeline would be installed in a trench 2.4 m (8 feet) deep and 1 m (3 feet) wide. Digging the trench through a wetland could result in three types of risks that could alter wetland hydrology:

- draining a wetland by allowing water to flow out of the wetland along the pipeline trench, because the replaced material in the trench would have greater hydraulic conductivity than the surrounding undisturbed soils;

- draining a wetland through the subsoil by puncturing the impermeable layer with the trench; and

- altering the subbasin that drains to a particular wetland by diverting subsurface flows through the trench and away from the wetland.

Factors that were used to determine the risk of altering wetland hydrology included the source of water to the wetland (e.g., groundwater, surface runoff, or streamflow), landscape position, size, surficial geology, and soils. Table B-2 in Appendix B summarizes these factors for most of the 78 wetlands and identifies the wetlands at risk for hydrologic changes.

Based on the analysis by Dames & Moore, 5 of the 78 wetlands are located in a site that could be drained through the pipeline trench. Wetlands located in a topographic depression or river valley would not be drained through the trench because the trench in the wetland is at the lowest point in the surrounding landscape. The only wetlands subject to being drained by the trench are those located on slopes that are also crossed by the pipeline trench in a direction other than parallel to the slope. The potential hydrologic risk to the five wetlands identified by Dames & Moore is water flowing downslope away from the wetland through the trench, presumably in material with greater hydraulic conductivity than the undisturbed native material.

To reduce the potential for this impact, trench plugs would be placed in the trench at the downslope side of the wetland to prevent the water from following the trench and to maintain wetland hydrology. Trench plugs would be impervious material such as concrete or compacted clay and would be keyed into the trench walls to prevent downslope subsurface water movement away from the wetland.

Trenching would not drain wetlands through the subsoil if the impermeable layer (soil or geologic feature) extends to a depth greater than the depth of the pipeline trench. All wetlands located on compacted glacial till, or in alluvium associated with a river or stream or supported by groundwater discharge, are not expected to be affected by this risk category. Based on the analysis, 25 wetlands are considered to be potentially at risk from draining through subsoils if no protective measures are taken. To prevent the eventual draining of the wetland, wetland and soil specialists monitoring the wetland trenching would identify those sites where an impervious layer would be installed in the pipeline trench before backfilling. Impervious trenches would be connected with or overlayed on existing layers to make a continuous seal.

The third risk category, altering upslope hydrologic flow patterns above the wetland, could occur at three wetlands in King and Kittitas Counties (Wetland Nos. 221013, 201309, and 191504). The pipeline corridor is located on a slope above these wetlands in an area where shallow subsurface

flow drains downslope to the wetland. To prevent potential hydrologic impacts on these wetlands, trench plugs would be installed within the pipeline trench to prevent shallow subsurface water from diverting along the trench and away from the wetland.

Indirect impacts on wetlands located outside of the construction corridor would be avoided by using the same methods to plug the trench line. Appropriate placement of trench plugs could be used to prevent subsurface flows from being rerouted away from wetlands downslope of the trench. Wetlands upslope of the trench could be protected by appropriate placement of trench plugs to prevent a lowering of the groundwater by subsurface flows following the trench.

Potential hydrologic impacts are considered minor because wetland and soil specialists would monitor all wetlands during construction to determine if trench plugs, impervious seals, surface berms, or other measures should be implemented to prevent draining of any wetland. Wetland and soil specialists would be present during construction in all wetlands to identify the relationship between wetland hydrology and soil conditions to ensure the subsurface soil conditions are reestablished during the backfilling of the trench. Maintaining subsurface features to support wetland hydrology would help to retain wetland functions associated with the hydrologic regime of the wetland.

Directional Drilling Under Roads. Drilling under four roads would require staging the boring entry site in the wetlands adjacent to the roads. At two of the wetlands (Nos. 270522A and 270729), the proposal includes use of trench plugs and seals at appropriate places to prevent a preferential path for subsurface flow to follow the pipeline. A soil scientist and/or geologist would be onsite to help determine the locations and designs of the plugs and seals around the pipeline.

Altered wetland hydrology is not expected at Wetland No. 270625B (a Category III wetland along SR 203 in Snohomish County) from drilling because the wetland is located on a deep alluvial soil with wetland hydrology supported by groundwater associated with the Snoqualmie River Valley and surface runoff. The fourth wetland where drilling would occur, Wetland No. 260727A (Harris Creek crossing) is not expected to result in altered wetland hydrology. Wetland hydrology is supported by groundwater associated with Harris Creek and the 183 m (600-foot) wide floodplain. Trenching or drilling in the deep alluvial soils associated with the floodplain is not expected to break through any impervious layers that create a perched groundwater system. The pipeline trench is not expected to "drain" water away from the wetland because the pipeline trench crosses the valley and runs upslope on both sides of the wetland floodplain.

Onsite restoration as previously discussed would be completed to rectify wetland impacts associated with drilling in the construction corridor.

Water Quality Impacts. Construction of the pipeline could introduce sediments into wetlands. Water quality of the wetlands would be degraded if preventive measures are not taken. While working in wet sections of trenches or directional drilling pits, the trenches or pits would be de-watered to maintain safe working conditions. Water removed from the trench would not be discharged into streams or wetlands without first controlling the sediments with temporary sediment basins and filter fences.

To reduce the potential of chemicals and toxic substances from construction equipment entering the wetlands, the spill prevention and control plan would be followed during and after construction. All vehicle fueling and maintenance would occur outside of the wetland and surrounding buffer.

Potential water quality impacts would be considered minor if measures (discussed in Section 3.6, Water and Appendix C) are successfully implemented.

Wildlife Impacts. Three wetlands (Wetland Nos. 270619B, 270628, 260717) in western Washington were observed to provide habitat for osprey (a state species of recreational value as determined by WDFW) or pileated woodpecker (a state candidate species for threatened status). Wetlands in the Crab Creek area contain habitat suitable for sandhill crane. Measures to reduce impacts on special-status wildlife species are discussed in Section 3.5, Wildlife.

Construction Impacts - Alternative Segments. The alternative corridor segments along I-90 and alternative Columbia River crossings, are located in the shrub-steppe communities of eastern Washington. Because of the uncommon occurrence of wetlands in shrub-steppe communities in this portion of the proposed corridor, wetland impacts are very similar between the proposed route and the alternative segments. Wetland impacts for the different alternatives are discussed below.

Columbia River Approach Options. Wetland impact acreage would be 0.03 ha (0.08 acre) greater for the YTC segment option south of I-90, in the YTC than the proposal. The alternative segment south of I-90 would impact two scrub-shrub wetlands (a Category II and a Category III wetland) totaling 0.03 ha (0.08 acre). An alternative segment south of I-90 along the fenceline within the YTC would avoid the two wetlands and wetland impacts would be similar to the proposed route.

Columbia River Crossing Options. In addition to the proposed Columbia River crossing method (horizontally drill a crossing below Wanapum Dam), OPL has identified four alternative Columbia River crossing routes: dredging a crossing north of I-90, attaching the pipeline to the I-90 Bridge, crossing on Wanapum Dam, or attaching the pipeline to the Burlington Northern Beverly Railroad Bridge. There are various approach routes to the alternative crossing sites.

Assuming the crossing of the Columbia River at or north of the I-90 Bridge would utilize the proposed route north of I-90, no additional wetland impacts have been recorded.

No wetlands were recorded to occur along the alternative segments that would continue the pipeline from approximately MP 149 south to the Burlington Northern Beverly Railroad Bridge and then north to reconnect with the proposed corridor east of the Columbia River (Heal pers. comm.). Therefore, no additional wetland impacts would occur from crossing the Columbia River at the Burlington Northern Beverly Railroad Bridge as compared to the proposal.

Operational Impacts. Operational impacts are those impacts that would occur after the pipeline is constructed. Such impacts would be associated with the maintenance of the line or pipeline breaks and spills.

Vegetation Clearing for Maintenance. Maintenance of the pipeline corridor would require the permanent removal of trees growing within a 9.1 m (30-foot) corridor. This would be done to allow visual inspection of the pipeline from the air and to prevent the roots of woody vegetation from damaging the pipe.

Tree clearing could be required as a maintenance activity in the forested wetlands along the proposed corridor. As previously mentioned, 0.22 ha (0.54 acre) of forested wetland occurs within the 9.1 m (30-foot) construction corridor. After tree clearing has occurred for pipeline construction, this forested wetland area would continue to be maintained as an emergent and/or scrub-shrub wetland during operation of the pipeline. Maintenance tree clearing in wetlands along the pipeline would be done by cutting vegetation with saws and tree trimmers. Herbicides would not be used in wetlands along the corridor for vegetation maintenance. Emergent and scrub-shrub wetlands would be allowed to grow naturally once the pipeline is installed.

Maintenance of a 9.1 m (30-foot) wide visual corridor represents a minor impact because of the limited amount of forested wetland area that would be affected along the pipeline corridor. In addition, no wetland area would be lost permanently except for the permanent conversion of 0.22 ha (0.54 acres) to emergent or scrub/shrub wetland, and all wetlands would be revegetated with herbaceous and shrub vegetation to create some habitat value and resource protection.

Spills. Impacts from a spill are uncertain because the location and extent of a potential spill are unpredictable, except in terms of risk frequency (see Appendix A, Spill Risk Information, and Section 3.18, Health and Safety). However, all wetland plants are vulnerable to the effects of a petroleum product spill. Effects on vegetation would depend on the season, location, volume, and product at the point where the spill occurred. Effects of a spill or spray on wetland vegetation would be similar to that described under Section 3.3, Botanical Resources.

Specific impacts on wetlands would occur given a large enough volume of spill that reaches plant foliage or wetland soil. A jet fuel spill on marsh vegetation at Vancouver International Airport in British Columbia indicated acute short-term impacts on vegetation as well as potential long-term chronic effects (Moody 1990). In the most severely affected areas, marsh species responded differently to the fuel spill, although a few individuals of bulrush remained 5 months after the spill. Most vegetation was unable to recover in 5 months in the severely affected areas, although some stunted annual species were able to invade the site. In lightly affected fuel spill areas, marsh vegetation could recover if the roots were not damaged either by translocation of fuel from the leaves to the roots or accumulation in the soil. The study of the Vancouver spill indicated jet fuel had the most toxic effect on new growth (shoots and leaves); vegetation recovery of the marsh appeared to be occurring in the less severely affected sites.

Cumulative Impacts. The proposed project would not result in the permanent loss of any wetland area and would not contribute to the gradual decline of wetland area in Washington. All wetlands would be restored to their previous condition except for 0.22 ha (0.54 acre) of forested wetland which would be restored to scrub-shrub wetland. In addition to the onsite restoration at pipeline construction impact sites, approximately 5.9 ha (14.5 acres) of degraded wetland would be enhanced to further compensate for wetland impacts.

3.4.2.2 No Action

The No Action Alternative would not have direct impacts on wetlands. Impacts from the proposal would not occur, although operational impacts on some wetlands would continue for maintenance of the existing north-south pipeline, including clearing of trees and large shrubs from existing corridors. Wetlands along road corridors would continue to be at slight risk from oil spills associated with increased trucking activities to transport oil from western Washington to eastern Washington. Intertidal mudflat and salt marsh wetlands would be at slight risk from 12 to 20 barges per month in Puget Sound, the Strait, and along the coast to the Columbia River.

3.4.3 Additional Proposed Mitigation Measures

3.4.3.1 Construction Mitigation and Subsequent Impacts

OPL has included BMPs to minimize wetland impacts (Appendix C). Additional mitigation measures, beyond those proposed by OPL, that could be used to further reduce impacts are as follows:

- Return construction corridors to their original contours after the pipeline is installed and before revegetation begins. This would reestablish surface water flow.

- Ensure noxious weed infestations do not become a problem in wetlands by conducting a weed inventory 1 year after construction to determine the extent noxious weeds may have invaded disturbed areas. Develop and implement a plan approved by the local county noxious weed control board as described in Section 3.3, Botanical Resources, to ensure that noxious weed prevention is successful..

- Prepare a wetland mitigation plan before any ground disturbance begins that focuses on replacing wetland functions at impacted wetlands as identified in the wetland report for this project. The plan would include a restoration design that specifies plant material size, planting densities, planting methods, seed mixes, application rates, timing of planting, and seed application. Monitor the revegetation plantings to ensure the revegetation plan is implemented as designed. The restoration plan would include locations of wetland enhancement sites and specific planting plans for those areas. All wetland restoration plan details would need approval by the ACOE as part of the Section 404 federal permitting process and by local agencies (through EFSEC) where wetland impacts would occur.

- Prepare and implement a monitoring plan that describes performance standards and contingency plans for the off-site wetland restoration and enhancement program.

- Identify the locations of temporary sediment basins and other means to control sediment, and routing of water pumped from wetland trenches and pits, before construction activities begin so that runoff can be routed immediately.

- Avoid an additional 0.2 ha (0.58 acre) of impacts at three Category I wetlands where directional drilling staging areas would be needed to bore under roads. Impacts at Wetland Nos. 270522A, 270729, and 260727A could be avoided by moving the boring entry site outside of the wetland to bore under the road and wetland.

- Use vehicle crossing mats to support equipment used for digging the trench which would minimize soil compaction and disturbance to vegetation not removed for trenching.

- Pipe would be welded together in sufficient lengths to cross each wetland before lowering the pipeline into the trench.

- Stockpiled subsoils and topsoils would be stored in uplands to avoid covering wetland vegetation.

Implementation of these mitigation measures would further minimize the potential impacts of the proposal by avoiding an additional 0.2 ha (0.58 acre) of a Category I wetland, minimizing sedimentation of wetlands, and helping to ensure revegetation and restoration efforts are successful.

The mitigation measures, combined with the measures described as part of the proposal, that would be used to minimize impacts on vegetation, hydrology, and soil conditions in the wetlands would help ensure wetland functions would be replaced. As previously stated, a 9.1 m (30-foot) corridor would be affected in the wetland, not the entire wetland. Therefore, functions such as biological support, wildlife habitat, filtration of sediments and capturing pollutants from surrounding runoff, and floodflow moderation would be maintained to some degree because the majority of the wetland area would not be disturbed from the construction corridor. Replacing subsurface soil conditions to maintain surface and subsurface hydrology conditions in the wetland and replanting wetland vegetation with native species common to the wetlands would, over a relatively short time (approximately 5 years), replace wetland functions described in the wetland report (Dames & Moore 1997).

3.4.3.2 Operational Mitigation and Subsequent Impacts

No additional mitigation is proposed because of OPL's commitment to enhance 0.4 ha (1.1 acres) of degraded emergent wetlands to forested wetlands as compensation for the loss of 0.22 hectare (0.54 acre) of forested wetlands. Additional mitigation would be required if a spill occurs and wetland vegetation is killed.

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3.5 WILDLIFE

This section first addresses federally listed threatened and endangered animal species, designated critical habitat, and other species and habitats that have been identified by WDFW, USFWS, and/or USFS as sensitive as of January 1998, which, for this EIS, includes a wide range of classifications (e.g., state candidate, USFWS species of concern, USFS monitor species, etc.). Impacts on other "general" wildlife species that do not have a special-status designation, such as deer, elk, and hawks, as well as general wildlife habitats, are subsequently addressed.

3.5.1 Affected Environment

3.5.1.1 Threatened, Endangered, and Other Special-Status Wildlife Species and Habitats

This section focuses on special-status mammals, birds, reptiles, and amphibians. Fish and plant species listed as threatened, endangered, or candidates for listing under the Endangered Species Act, as well as other special-status fish and plants, are addressed in Section 3.7, Fisheries and Section 3.3, Botanical Resources.

Unless otherwise noted, this section is based on information presented in the ASC (OPL 1998) and technical reports prepared for this proposal (Dames & Moore 1997a, 1997b). These sources are based on reconnaissance-level field surveys, WDFW sensitive animal site records, and review of literature. Protocol surveys were conducted for Larch Mountain salamander. Protocol surveys were not conducted for other species, including threatened and endangered species known to be present in the project vicinity, because (1) suitable habitat is assumed occupied, (2) occupied sites are well known and additional sites are unlikely (for bald eagle), and/or (3) project impacts could be shown to be adequately mitigated without the need for surveys at this time. As described in the mitigation section, clearance surveys for some threatened, endangered, and other wildlife species would be necessary prior to project construction to avoid adverse impacts.

A primary issue addressed in this EIS is the proposal's effect on wildlife species listed as either threatened or endangered under the Endangered Species Act (ESA) -- referred to simply as "listed species". A similar issue addressed is the proposal's effect on Critical Habitat Units (CHUs), which are also designated and protected under the ESA. CHUs are lands specifically designated to protect a listed species and receive generally the same protection as listed species.

The USFWS identified listed species and CHUs that may occur in the vicinity of the proposal (Dames & Moore 1997a). Table 3.5-1 summarizes the habitat requirements, known occurrences, and potential for these listed species to occur within the affected environment. The following paragraphs provide additional information about listed species and habitats that could be affected by the project.

Table 3.5-1. Threatened and Endangered Species Evaluated in the Vicinity of the Proposed Pipeline Project

Species	Status	Habitat Association	Potential for Using Specific Areas Proposed for Development	Notes
peregrine falcon (*Falco peregrinus*)	E	Cliffs (for nesting), concentrations of waterfowl/other birds (Johnsgard 1990).	Potential pass-through migrant; potentially suitable nesting habitat along the Columbia River.	No known nest sites found during WDFW surveys of Snoqualmie Pass area.
'gray wolf (*Canis lupus*)	E	Wilderness; isolation from human disturbance for denning (Chapman and Feldhammer 1982).	Habitat marginal due to human activities. Potential pass-through use as part of much larger territories; otherwise, absent.	No packs, den sites, or rendezvous areas known or suspected near project.
grizzly bear (*Ursus arctos horribilis*)	T	Vast areas of wilderness; meadows, wet areas, open slopes with huckleberries for foraging (U.S. Fish and Wildlife Service 1982).	Regular use of the area highly doubtful due to human activities, high road density, and lack of sightings. Marginal habitat otherwise.	Project is outside of defined recovery zone and away from optimum habitat identified in the Alpine Lakes Wilderness (Wenatchee National Forest 1997).
marbled murrelet (*Brachyramphus marmoratus marmoratus*)	T	Requires mature and old-growth forest with trees having large-diameter branches for nesting (Hamer and Cummins 1991, Murrelet Report).	Absent due to lack of suitable nesting habitat.	No sightings reported.
northern spotted owl (*Strix occidentalis caurina*)	T	Requires mature and old-growth forest, with multiple canopy layers and large amounts of dead and down woody material; typically below 4,500 feet in western Washington (Thomas et al. 1993).	No nest sites occur within the 0.25 mile disturbance buffer.	No suitable habitat within areas that would be disturbed.
bald eagle (*Haliaeetus leucocephalus*)	T	Almost always found near large bodies of water where primary prey items of fish and waterfowl can be found (USFWS 1986).	No nest sites near project area. Wintering occurs near major streams and rivers.	Regular winter use documented along Snoqualmie, Yakima, and Columbia Rivers (WDFW 1987).

T = Threatened, E = Endangered

Northern Spotted Owl Nest Sites. Northern spotted owls are present near the pipeline corridor, generally on or within 2 km (1.2 miles) of USFS land. Recent survey data of spotted owl locations is available for most of the pipeline corridor, due to recent USFS and Plum Creek Timber Company surveys (USFS/USFWS 1997).

The two key project issues related to northern spotted owls and the proposal are (1) possible nest site disturbance, and (2) possible habitat loss. The USFS considers nest site disturbance to occur when a nesting pair of northern spotted owls may be disturbed by construction activities within 0.4 km (0.25 mile) of an active nest site during the breeding season. Based on the existing survey data, the closest known northern spotted owl nest site is 0.8 km (0.50 mile) from where disturbance would occur[1]. However, northern spotted owl data are generally only acceptable for 2 years, and the entire alignment has not been surveyed. In the absence of additional surveys, any suitable nesting habitat within 0.4 km (0.25 mile) is assumed to be occupied by a nesting pair. Although much of the habitat adjacent to the proposal is not suitable for nesting, some habitat occurs within 0.4 km (0.25 mile) of the pipeline corridor. However, no habitat suitable for northern spotted owl nesting is present within the 18.3 m (60-foot) wide construction corridor itself.

For habitat loss, the USFWS, USFS, and WDFW consider that adverse effects on a nesting pair may occur if suitable habitat is removed within 2.9 km (1.8 miles) of a nest site or activity center. While the proposal would come within the 2.9 km (1.8-mile) management radius of 13 known nest sites, no suitable habitat is present within 2.9 km (1.8 mile) of areas where vegetation would be removed or otherwise disturbed.

Marbled Murrelet Nest Sites. No known marbled murrelet nest sites are present within the pipeline corridor; however, the entire corridor has not been surveyed so, potentially, unknown nest sites may be present. No suitable habitat is present within the proposed 9.1 m (30-foot) construction corridor.

Designated Critical Habitat for Northern Spotted Owl and Marbled Murrelet. The project would cross within and near areas that have been designated as critical habitat for northern spotted owl and that may meet the definition of critical habitat for marbled murrelet. The determination of impact and mitigation for these critical habitats is conducted through the ESA and not through NEPA. However, to meet the disclosure requirements for NEPA, this analysis identifies the types of impacts that may occur and makes reasonable predictions as to the likelihood that impacts can be effectively mitigated.

To understand potential impacts and mitigation, it is important to distinguish between designated critical habitat (called CHUs), which is a regulatory definition, and habitat which is currently suitable, which is a biological definition. As previously mentioned, CHUs are lands specifically designated by the USFWS to protect a listed species. Suitable habitat, on the other hand, are lands that provide shelter, food, breeding sites, foraging habitat, or other key features the animal

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[1]Because of the sensitivity of nest site data, the WDFW generally prefers to provide exact locations on a need-to-know basis; therefore, the exact location of these nest sites is not reported in this EIS, although these locations were determined as part of the impact analysis.

needs to survive. Because CHUs are regulatory, and suitable habitat is biological, not all suitable habitat for marbled murrelet or northern spotted owl is necessarily within designated CHUs, and, conversely, not all areas within designated CHUs for these species are necessarily suitable habitat.

A further distinction must be made between designated CHUs for marbled murrelet and designated CHUs for northern spotted owl. The USFWS has delineated specific areas as CHUs for each of these species. However, for marbled murrelet CHUs, forested habitat must have certain characteristics to be considered designated CHUs. For northern spotted owl CHUs, generally all habitat that has the potential to become suitable is considered designated critical habitat within the CHUs.

With the distinction between CHUs and suitable habitat being made, and the distinction between marbled murrelet CHUs and northern spotted owl CHUs being made, habitat within the areas that would be cleared by the project is not currently biologically suitable for either northern spotted owl or marbled murrelet because the forest is much too young to provide the necessary structural components to meet the needs of the species to breed, feed, or seek shelter. However, habitat meeting the regulatory definition of CHUs for northern spotted owl is present within the 0.8 km (0.5-mile) long by 9.1 m (30-foot) wide section of new corridor that would be constructed between the Annette Lake Trailhead area and the John Wayne trail.

This same 0.8 km (0.5-mile) section may meet the regulatory definition for CHUs for marbled murrelet, as defined in the final designation published in the Federal Register on May 24, 1996. However, trees may not meet the required one-half site-potential tree height to qualify as marbled murrelet designated CHUs. The USFS, in consultation with the USFWS, will determine which, if any, habitat meets the CHUs requirements for marbled murrelet, under the consultation requirements of the ESA.

Bald Eagle. The affected environment contains no bald eagle nests, based on documented nesting records maintained by the WDFW (WDFW 1997). None are located within 2 km (1.2 miles) of proposed activities, which is well beyond the maximum recommended buffer distance of 0.8 km (0.5 mile) (Rodrick and Milner 1991). A bald eagle nest is located approximately 2.9 km (1.8 miles) west of the proposal near the Snoqualmie River north of Carnation, and another is located near Lake Cle Elum, several kilometers north of the proposal. Both are sufficiently far from the proposal to be considered outside of the affected environment. In addition, the Yakima Watershed Analysis (Wenatchee National Forest 1997) identified potential bald eagle nest territories along Keechelus Lake; however, no eagles had established nest sites there as of the 1997 nesting season.

Bald eagle wintering populations occur along the Snoqualmie River Valley, Tolt River, South Fork Snoqualmie River, Keechelus Lake, Yakima River, Columbia River, and lower Crab Creek. In addition, waterfowl, which are a primary food stock of wintering bald eagles, concentrate in large flocks on the Columbia River where the pipeline would cross.

Gray Wolf and Grizzly Bear. Gray wolf and grizzly bear are not substantial elements of the affected environment because:

- Both species avoid areas with human activity, and the proposal would be located within an area of high human activity and past land disturbance (e.g., the Snoqualmie Pass Recreation Area, I-90, logging roads, and extensive fire and logging history).

- Very few grizzlies or wolves are believed to exist in the Washington Cascades. No key grizzly or wolf use areas, including den sites, are expected to be within the pipeline corridor (Wenatchee National Forest 1997, WDFW 1997).

- The proposal is outside of the defined recovery zone for grizzly bear (U.S. Fish and Wildlife Service 1982). The U.S. Fish and Wildlife Service has not yet defined a recovery zone for the gray wolf.

- The proposal is not near optimum habitat for either species, as identified in the Alpine Lakes Wilderness Area (Wenatchee National Forest 1997, USFS/USFWS 1997).

Peregrine Falcon. Peregrine falcons are most sensitive at nest sites, which may be affected by activities that occur within a 0.4-0.8 km (0.25-0.5 mile) radius (Olsen and Olsen 1980). No known nest sites are located within this distance from where disturbance would take place. The Columbia River area is the only area that contains such suitable habitat within this distance. The Snoqualmie Pass area contains potential peregrine nest habitat, but not within this distance (USFS/USFWS 1997).

The project area would not cross any reported winter use or foraging areas for peregrine falcon. The Columbia River area contains suitable habitat, and essentially the entire alignment could be used occasionally by peregrine falcons, either as part of much larger foraging territories or as rest-over habitat during migration.

Other Special-Status Wildlife Species and Habitats. In addition to wildlife species and habitats protected under the ESA, the USFS, USFWS, and WDFW identify other wildlife species and habitats that they consider important to protect, including:

- USFS sensitive species;

- USFWS Species of Special Concern (formally classified as candidate species);

- USFS "survey and manage" species, which are those species for which the USFS directives are to survey for and then manage as part of planning for ground disturbing activities under the Northwest Forest Plan ROD (USFS/BLM 1994);

- USFS management indicator species, as identified in the Mt. Baker-Snoqualmie and Wenatchee National Forest Land and Resource Management Plans (USFS 1990a, 1990b); and

- priority habitats, as defined and designated by the WDFW.

With the exception of survey and manage species, which must be addressed for all land-disturbing activities on BLM or USFS lands, the designation of these species is largely advisory, with no specific regulatory authority. For simplicity, this EIS refers to all of these species collectively as "sensitive." Table 3.5-2 lists sensitive species evaluated but found not to be significant elements of the affected environment, while Table 3.5-3 lists sensitive species that are part of the affected environment to be addressed in this EIS because they are likely to be present in the vicinity of the proposal. The following section discusses WDFW-designated priority habitats along the pipeline corridor.

Priority Habitats. Priority habitat types are those that the WDFW has determined to be important to many species, and include the habitat types of highest value to wildlife within the project area, including habitats on private and public lands. The WDFW provides definitions of these priority habitat types (WDFW 1996) and maps areas where these habitats are known to occur. WDFW designation of an area as a priority habitat type is advisory only, and carries no legal protection, although such designation may increase the significance of impacts, as evaluated through SEPA and/or NEPA. The following paragraphs detail priority habitats addressed in this EIS.

Shrub-Steppe. Shrub-steppe is the predominant native habitat type from approximately Ellensburg to Pasco; however, large-scale conversion to cropland and rangeland has left only about 5 percent of the historic extent of shrub-steppe in relatively undisturbed condition. The WDFW considers undisturbed shrub-steppe habitat as a priority habitat type because of its limited occurrence and habitat features important to wildlife species (WDFW 1996).

While undisturbed shrub-steppe habitat is very rare, moderately disturbed shrub-steppe communities are fairly common, being impacted to various degrees from grazing, weed infestations, and other disturbances. Most (about 74 percent) of the shrub-steppe habitat crossed by the pipeline corridor has been substantially disturbed, with non-native grasses (e.g., cheatgrass and bulbous bluegrass) being equal or greater in distribution than native grasses (e.g., bluebunch wheatgrass and Idaho fescue). This habitat can still provide cover and food for many types of wildlife, but it does not constitute a high-quality shrub-steppe community and is not likely to support many of the species that depend on healthy shrub-steppe communities (e.g., sage thrasher, loggerhead shrike).

As described in Section 3.3, Botanical Resources, the pipeline corridor would cross only one area of relatively undisturbed shrub-steppe, located on the eastern slopes above the Columbia River. This area, which the pipeline would cross for approximately 457 m (1,500 feet), is dominated by native grasses and sagebrush with an intact cryptogam crust (a thin layer of moss and lichen that indicates an undisturbed community).

About 26 percent of the shrub-steppe habitat within the pipeline corridor contains mostly native shrubs (e.g., big sagebrush and bitterbrush) with a predominantly native grass understory. This habitat type, while previously disturbed by grazing, off-road vehicle use, and other disturbances, still provides cover, food, and nesting habitat for many species of wildlife. The importance of these areas is enhanced by the overall lack of vegetative cover during winter within the cultivated fields that are common in the area. Some of these shrub-steppe areas are likely to provide important wintering habitat for resident wildlife, including game species, such as pheasant and chuckar, as well as native mammals and birds.

Table 3.5-2. Sensitive Animal Species that Are Not Significant Elements of the Affected Environment for the Proposed Pipeline Project

Species	Status	Key Habitats and/or Decision Factors	Reason Why Not Considered Significant Element of the Environment
lynx (*Lynx canadensis*)	FSS, SpC, ST	Protection and management of core habitats and areas of regular occurrence, which, in Washington, are limited to lodgepole pine forest in the Okanogan area (Rodrick and Milner 1991).	Project area outside the core range of lynx (Rodrick and Milner 1991). Absent or rare pass-through use due to lack of habitat and known populations.
mountain goat (*Oreamnos americanus*)	MBS, MIS	Protection of winter range and "kidding" areas. Steep mountainous terrain supporting herbaceous and woody vegetation (Wigal and Coggins 1982).	Present at high elevations outside of project area.
California wolverine (*Gulo gulo luteus*)	FSS, SpC	Neonatal areas key management concern. A habitat generalist, requires large areas away from roads and human disturbances (Banci 1994).	Project area is too developed to provide key habitat. No neonatal habitat identified in the project area. Either absent or rare pass-through use as part of vast territory. Most likely use area is in the Alpine Lakes Wilderness and within higher elevation roadless areas.
common loon (*Gavia immer*)	FSS	Protection of breeding sites, which are exceedingly rare. These occur in large lakes with minimal human disturbance (Rodrick and Milner 1991).	Foraging individuals occasionally present in larger lakes and rivers, particularly Keechelus Lake and the Columbia River. Breeding absent due to lack of large lakes with minimal human disturbance in project area.
Pacific fisher (*Martes pennanti pacifica*)	SpC, SC,	Requires extensive forest stands with contiguous canopy (Powell 1981). Major concern is large-scale habitat alteration (e.g., timber harvest within a subwatershed).	Potential pass-through or foraging use, although habitat is generally unsuitable due to openness of cleared corridor. New corridor areas may be part of much larger home ranges.
Larch Mountain salamander (*Plteethodon larselli*)	ROD	Protection of talus and/or old-growth forest. Requires loosely consolidated substrate for burrowing.	Absent, as determined by direct surveys of potential habitat (Dames & Moore 1997a).
Van Dyke's salamander (*Plethodon vandykei*)	ROD	Protection of all habitat, which includes mostly splash zones of streams.	Absent, as determined by direct surveys of potential habitat (Dames & Moore 1997a).
long-legged myotis (*Myotis volans*)	SpC, SC	Protection of breeding habitat. Widespread within a wide range of habitats (Barbour and Davis 1969). Breeds in caves, abandoned mine tunnels, and attics.	Potential foraging. Breeding unlikely due to lack of required cave habitat.

Continued

Table 3.5-2. Sensitive Animal Species that Are Not Significant Elements of the Affected Environment for the Proposed Pipeline Project

Species	Status	Key Habitats and/or Decision Factors	Reason Why Not Considered Significant Element of the Environment
Pacific western big-eared bat (*Plecotus townsendii townsenii*)	SpC, SC, FSS	Protection of caves, buildings, and mineshafts used for roosting and breeding (Christy and West 1993).	No key habitat present, although the species could forage within pipeline corridor. Snoqualmie Pass Tunnel receives too much human disturbance to be considered habitat.
white-headed woodpecker (*Picoides albolarvatus*)	SC	Protection of breeding areas. Requires old-growth ponderosa pine and/or lodgepole pine forests.	No key habitat present within areas that would be disturbed.
black-backed woodpecker (*Picoides arcticus*)	SC	Protection of breeding areas. Requires old-growth ponderosa pine and/or lodgepole pine forests.	No key habitat present within areas that would be disturbed.
Columbian sharp-tailed grouse (*Tympanuchus phasianellus columbianus*)	SC	Protection of breeding areas, regular occurrence.	Project outside of species' range (Yocom 1952, Hofmann and Dobler 1988), although occasional use near the YTC may be possible. Such use is considered minor and not likely to be significantly affected by short-term disturbance or habitat modifications.
Great gray owl (*Strix nebulosa*)	ROD	Protection of nest sites.	Project outside of known nesting population's range. No reports of nesting anywhere near the project.
western sage grouse (*Centrocercus urophasianus phaios*)	SpC, SC	Protection of breeding areas, regular occurrence.	Present at YTC, but project is north of species' range (Cadwell et al. 1994).
Vaux's swift (*Chaetura vauxi*)	MBS	Protection of nest trees. Requires large, hollow trees for roosting and nesting (Rodrick and Milner 1991).	Likely foraging use, but otherwise absent due to lack of large, hollow trees within pipeline corridor.

Notes:

FSS = Forest Service Sensitive Species
SpC = U.S. Fish and Wildlife Species of Concern
SM = Survey and Manage
MBS = Mt. Baker - Snoqualmie National Forest Sensitive Species
MIS = Management Indicator Species
SC = State Candidate
ST = State Threatened
ROD = Survey and Manage Species Identified in the ROD for the Northwest Forest Plan (USFS/BLM 1994)

Table 3.5-3. Sensitive Animal Species Likely Present in the Vicinity of the Proposed Pipeline Project

Species	Status	Key Habitats and/or Decision Factors	Potential for Using Specific Areas Proposed for Development
Cascades frog (*Rana cascadae*)	SpC	Any occurrence. Edges of seeps and other wetlands (Leonard et al. 1993). Highly aquatic species.	Present within seeps, springs, ponds and other wetlands and riparian areas on USFS lands.
Spotted frog (*Rana pretiosa*)	SpC	Breeding areas (wetlands)	Present in the Cascades east of the Cascade Crest.
western toad (*Bufo boreas*)	SpC	Breeding areas (wetlands)	Present in forested areas of project.
northern leopard frog (*Rana pipiens*)	SC	Breeding areas, including wetlands, ponds, and associated riparian areas.	May be present in lower Crab Creek area.
northern reg legged frog (*Rana aurora*)	SC	Breeding areas (wetlands)	Present in forested areas of project.
northern goshawk (*Accipiter gentilis*)	SpC, SC MBS	Nest sites and related foraging habitat. Generally found in large stands of multi-layered, old-growth forest containing small openings (Reynolds et al. 1992).	Present throughout forested portions of the project area, especially on USFS lands.
osprey (*Pandion haliaetus*)	PHS	Nest sites and primary foraging areas. Almost always found near fish-bearing water (Rodrick and Milner 1991).	Known nest sites present south of Keechelus Lake, approximately 400 m (0.25 mile) from pipeline corridor
prairie falcon (*Falco mexicanus*)	PHS	Nest sites. Typically found on cliffs (Johnsgard).	Known nest sites present near Swauk Creek Valley and near the Columbia River crossing area.
ferruginous hawk (*Buteo regalis*)	ST	Protection of nest sites, which are typically in basalt outcrops within open prairie.	Foraging habitat present, but no known nests within affected environment. Closest historic nest site is 1.6 km (1 mile), reported in 1988 (Dames & Moore 1997a). Other nests may be present.
burrowing owl (*Athene cunicularia*)	SC	Nest burrows. Inhabit dry open areas.	Known nest sites present near Vantage (north of I-90 route alternative), near Royal City, and about midway between Royal City and Pasco. Closest known burrow is 156 m (513 feet) from pipeline corridor. Others possible.
flammulated owl (*Otus flammeolus*)	SC	Requires open, mature ponderosa pine forests with open canopies.	No known nests sites in vicinity of the project, but potential habitat exists in Kittitas County.
sandhill crane (*Grus canadensis*)	SE	Nest sites, regular large concentrations, migration staging areas.	Project would cross major spring and fall staging area in the Lower Crab Creek Valley, where large flocks congregate to feed, rest, and seek shelter on their way to and from breeding and wintering areas.
long-billed curlew (*Numenius americanus*)	PHS	Breeding areas and regular concentrations in spring and summer.	Present in vicinity of project from Vantage to Pasco. Potential breeding may occur near proposed construction route.
loggerhead shrike (*Lanius ludovicianus*)	SC	Breeding areas and regular concentrations. Uses shrub-steppe habitats.	Nesting may occur in shrub habitat from Ellensburg to Pasco.
sage sparrow (*Amphispiza belli*)	SC	Breeding areas. Sagebrush obligates.	May be present in sagebrush communities.
sage thrasher (*Oreoscoptes montanus*)	SC	Breeding areas. Sagebrush obligates.	May be present in sagebrush communities.
sharptailed snake (*contia tenuis*)	PHS	Forested areas near streams	May be present in the Cle Elum area.
striped whipsnake (*Masticophis taeniatus*)	SC	Any occurrence. Hibernation sites most vulnerable to disturbance.	Present along Columbia River area.

Continued

Table 3.5-3. Sensitive Animal Species Likely Present in the Vicinity of the Proposed Pipeline Project

Species	Status	Key Habitats and/or Decision Factors	Potential for Using Specific Areas Proposed for Development
night snake (*Hypsiglena torquata*)	PHS	Any occurrence. Hibernation sites most vulnerable to disturbance.	Present along Columbia River area.
Washington ground squirrel (*Spermophilus washingtoni*)	SC	Regular large concentrations.	Known near the project in the Saddle Mountains area, north of the proposed Othello Pump Station. Possible anywhere between Vantage and Pasco.
olive-sided flycatcher (*Cantopus borralis*)	SpC	Breeding areas. Montane and northern coniferous forest with low percentage canopy cover (USFS 1991).	Present throughout forested portions of the project area.
turkey vulture (*Cathartes aura*)	PHS	Nest sites	Present throughout project area but most common in Clear Elum area. Nest near the South Cle Elum Ridge (700 m [2,296 feet] distant).
Swainson's hawk (*Buteo swainsoni*)	PHS	Nest sites. Uses isolated trees in open country.	Present from Cle Elum east. A nest east of Ellensburg (478 m [1,569 feet] distant).
tailed frog (*Ascaphus truei*)	SpC	Turbulent mountain streams (Leonard et al. 1993).	Documented near Keechelus Lake (Cold and Mosquito Creeks and near an unnamed creek at crossing 103). Assumed present in and near all stream crossings within the MBS and Wenatchee National Forests.
harlequin duck (*Histrionicus histrionicus*)	MBS, PHS, FSS	Clear, clean, swiftly flowing second to fifth order streams (Leonard et al 1993).	Presumed present. Project crosses over 50 streams with potential habitat, although few if any of these are likely to actually support breeding pairs, especially at the point of intersection (based on probability).
pileated woodpecker (*Dryocopus pileatus*)	MBS,MIS, SC	Mature forests with large amounts of snags and downed woody material (Bull 1987).	Present in habitats adjacent to pipeline corridor but little use within corridor due to lack of mature timber.

Notes:

FSS = Forest Service Sensitive Species
SpC = U.S. Fish and Wildlife Species of Concern
SM = Survey and Manage
MBS = Mt. Baker - Snoqualmie National Forest Sensitive Species
MIS = Management Indicator Species
SC = State Candidate
ST = State Threatened
PHS = General WDFW Priority Species
SE = State Endangered

Cliff. Cliffs provide secure habitat for nesting hawks and falcons as well as a variety of other wildlife, such as lizards, snakes, and upland game birds (e.g., chuckar). These areas provide important refuges for wildlife, in part because the steep terrain limits human and predator access. Both sides of the Columbia River contain cliffs that have been mapped by WDFW as priority habitats.

Riparian. Riparian habitat consists of vegetation along streams and rivers. These areas provide cover, food, water, and breeding habitat for many wildlife species. Because of the wet climate in western Washington, riparian habitat is often indistinguishable from undisturbed upland habitat. However, where logging or development has removed upland habitats, forested riparian strips can become refuges and travel corridors for wildlife.

In the much drier eastern Washington, shrubby thickets and forest groves within riparian areas often contrast sharply with dry, grass and/or cropland dominated uplands. Breeding birds and other wildlife depend on the shelter, water, and food provided by these riparian habitats.

The pipeline corridor would cross many riparian areas along streams and rivers. Many of the larger streams and rivers include floodplains supporting cottonwoods, willows, alders, and a dense assortment of shrubs. Examples include the shorelines of the Tolt, Snoqualmie, and Yakima Rivers, as well as many smaller streams. These areas typically support healthy populations of birds, mammals, and amphibians. Section 3.7, Fisheries, contains additional information regarding riparian habitat.

Wetlands. Wetlands provide habitat for many types of wildlife, some of which depend on wetlands for some or all of their life requirements, such as amphibians, waterfowl, and several species of wetland-obligate birds. The pipeline corridor crosses many wetlands, as detailed in Section 3.4, Wetlands. Wetlands are common in the Snoqualmie Valley, where they provide habitat for nesting waterfowl and other birds. Wetlands are also common in the lower Crab Creek area, where many ponds and larger wetlands are major nesting and brood rearing areas for waterfowl.

Woody Cover. East of the location for the proposed Beverly-Burke Pump Station, the pipeline corridor would cross several draws containing thickets of greasewood and other shrubs that provide important breeding and shelter habitat for pheasants and other wildlife.

Natural Open Space. Natural open spaces are remnant patches of wildlife habitats left within areas that have been mostly developed, either by urban development or by agriculture. These areas provide refuge to many species that would not otherwise be present. The pipeline corridor would cross three areas designated as Natural Open Space: a forested hillside near the Tolt River, a habitat patch near Lower Babcock Ridge, and another habitat patch along the Snake River near the Northwest Terminalling Facility at Pasco.

Oak Woodland. Oak woodlands have always been rare in Washington, and support some species that are equally rare. The pipeline corridor would require cutting some trees in an oak woodland in the Swauk Creek area.

Old-Growth/Mature Forests (Late-Successional Forest). Many animal species require old-growth or mature forests, including several species of woodpeckers and owls, salamanders, bats, and furbearers (e.g., marten, mink). No old-growth forest is within areas that would be cleared, although patches of old-growth and/or mature forest are present in the general vicinity of the pipeline corridor throughout most USFS lands, including near Tinkham Road, Snoqualmie Pass, and near Keechelus Lake; however, much of the timber in the Upper Yakima Watershed has been previously harvested (USFS/USFWS 1997) and most old-growth anywhere near the pipeline corridor is present in the Cle Elum Watershed and north of the pipeline corridor within the Alpine Lakes Wilderness Area.

3.5.1.2 General Wildlife Species and Habitats (Not Considered to be Special-Status)

General Habitat Types. The pipeline corridor crosses a wide range of habitat types, as described in Section 3.3. Table 3.5-4 describes these habitat types, in order of abundance within the pipeline corridor, along with typical wildlife species associated with them. Section 3.3, Botanical Resources, contains more information regarding plant communities. See also the Dames & Moore (1997b) vegetation technical report.

Table 3.5-4. General Habitat Types and Examples of Typical Common Wildlife Species within Proposed Pipeline Corridor

Plant Community	Approx. % of Corridor	Examples of Typical Common Wildlife Species
shrub-steppe	41	western skink, Say's phoebe, red-tailed hawk, northern harrier, common raven, chukar, great basin pocket mouse, bushy-tailed woodrat, Nuttall's cottontail, northern pocket gopher, yellow-bellied marmot, badger, mule deer
agricultural areas (cropland, hay/pasture, grass/forb)	33	European starling, Brewer's black-bird, brown-headed cowbird, ring-necked pheasant, gray partridge, horned lark, killdeer, northern flicker, red-tailed hawk, northern harrier, American kestrel, black-billed magpie, coyote, stripped skunk, deer mouse
scrub-shrub (shrubby plant communities, usually within maintained rights-of-way or recently harvested forest)	16	western fence lizard, northwestern garter snake, dark-eyed junco, song sparrow, mountain beaver, Townsend's mole, Townsend's vole, vagrant shrew, eastern cottontail
coniferous forest, west of the Cascade Crest	3	northwestern salamander, Pacific treefrog, chestnut-backed chickadee, bushtit, brown creeper, red-breasted nuthatch, varied thrush, bobcat, Douglas' squirrel, black bear
coniferous forest, east of the Cascade Crest	<1	common raven, hairy woodpecker, Clark's nutcracker, white-breasted nuthatch, chipping sparrow, Cassin's finch, yellow-pine chipmunk, porcupine, elk
deciduous/mixed forest, west of the Cascade Crest	<1	American robin, American/northwestern crow, Stellar's jay, black-capped chickadee, winter wren, downy woodpecker, western screech owl, ruffed grouse, racoon, eastern gray squirrel, black-tailed deer
vegetated urban/developed areas	1	white-crowned sparrow, American robin, European starling, Norway rat, deer mouse

General Wildlife Species Groups - Birds

Raptors. Raptors, which include hawks, falcons, owls, eagles, and vultures, are important species in that (1) they are protected under the Migratory Bird Treaty Act, (2) they are very visible to the public, and (3) people tend to highly regard raptors; they enjoy and appreciate seeing them and are often concerned about raptors being harmed by human activities, especially disturbance of nest sites.

Swainson's hawk, bald eagle, peregrine falcon, osprey, ferruginous hawk, prairie falcon, and turkey vulture are special-status species. Other raptors that may nest and/or feed within the vicinity of the proposal include red-tailed hawk, northern harrier, sharp-shinned hawk, Cooper's hawk, American kestrel, great horned owl, pygmy owl, saw-whet owl, and barn owl.

Cavity-Nesting Birds. Cavity-nesting birds nest within tree holes. Examples include woodpeckers, American kestrel, red-breasted nuthatch, western flycatcher, and black-capped chickadee. These species generally require large-diameter trees (generally greater than 30 cm [12 inches]). Most of the pipeline corridor does not contain habitat for cavity-nesting birds, although any of the forest types may contain some suitable nesting trees. In the arid portions of eastern Washington, cavity-nesting species may use old telephone poles or even fence posts as nest sites.

General Wildlife Species Groups - Mammals

Deer and Elk. Deer and elk occur throughout the project area. Important winter ranges occur at three areas identified by the WDFW: (1) the Taneum elk winter range west of the Yakima River crossing, (2) the Ellensburg mule deer winter ranges from the Yakima River crossing to about 24 km (15 miles) east, and (3) the Quilomene mule deer winter ranges from the pipeline corridor near Ryegrass Pass to east of the Columbia River crossing.

Deer and elk winter range are important because (1) deer and elk provide important recreational opportunities to people (e.g., hunting and wildlife observation) and are also a high public profile species, (2) winter range is often very limited due to development within lower elevation areas, and (3) the availability of winter range is a major factor in determining population levels, because most natural mortality occurs during winter (Thomas and Toweill 1982, Wallmo 1981). Protection of winter range is most critical during severe winters, when deer and elk have low energy reserves and cannot afford to expend energy to flee from disturbances.

Large Carnivores/Omnivores. This species group includes American marten, fisher, and Canada lynx (fisher and Canada lynx are also classified as sensitive species. See Tables 3.5-2 and 3.5-3.). American martens are fairly common in the Snoqualmie Pass area and are likely to occur within the project area anywhere within USFS lands, although they are most likely to occur within old-growth forest types. Fishers are much more closely tied to late-successional forests than martens and, due to the relative lack of such forests near the project area, are expected to occur relatively infrequently. Lynx are essentially absent from the project area and may have never been present in large numbers. Individual lynx may occasionally pass through the project area, but with such infrequency as to be considered absent from the affected environment.

Small Mammals. Many species of shrews, mice, voles, and moles are present within the affected environment. While small and often unnoticed by people, these species are often the most abundant wildlife within a given habitat, including early-successional habitats present within much of the project area.

Burrowing Mammals. Burrowing mammals such as northern pocket gopher and ground squirrels are known to occur in the Columbia Basin. Northern pocket gophers are plentiful throughout the region and are likely present throughout most of the proposal area from Ellensburg

east. Badgers are closely associated with burrowing mammals and are an important wildlife component of shrub-steppe and agricultural lands. Because burrowing animals usually require deep loose soil, areas containing deeper soils are the most suitable habitat for these species.

Bats. Many species of bats may be present within the project vicinity, including big brown bat, little brown bat, silvery-haired bat, yuma myotis, and California myotis. These bats breed and roost in trees, caves, or other habitats that provide shelter and relatively stable temperatures. No caves are known to be present near the pipeline corridor, and the forest communities that would be crossed are generally too young to provide the mature trees typically used by these species. However, bats could roost or breed within the cliff habitats near the Columbia River or possibly in the Snoqualmie Tunnel in the summer, although human use of the tunnel reduces the possibility.

Wildlife Travel Corridors. The Northwest Forest Plan identified the Snoqualmie Pass area as an important north-south travel corridor for wildlife, although current conditions greatly compromise this corridor. Recreational developments, logging, and I-90, as well as the barriers created by Cle Elum, Kachess, and Keechelus Lakes, create barriers to north-south movements. The project crosses the Snoqualmie Pass Adaptive Management Area where the USFS has proposed numerous actions to enhance north-south connections with a major emphasis on restoring old-growth forest.

3.5.2 Environmental Consequences

3.5.2.1 Proposed Petroleum Product Pipeline

Most impacts on wildlife would occur during construction. Impacts would include direct loss of habitat, temporary disturbance of habitat, disturbance caused by project noise and activities, and potentially direct mortality during construction. With ardent revegetation efforts, the direct loss of habitat could be greatly mitigated, potentially enhancing wildlife habitat values in some areas where existing vegetation is sparse or dominated by non-native species, such as within degraded shrub-steppe communities located on the eastern portion of the corridor.

Construction Impacts - Overall Proposal

Threatened, Endangered, and Other Sensitive Species and Habitats. Overall, the proposal would have minor to negligible impacts on species listed under the ESA because no regular use areas or currently suitable key habitats (e.g., primary breeding, feeding, or shelter areas) would be disturbed.

Should blasting be used as part of project construction, then northern spotted owl, marbled murrelet, and other sensitive species may be disturbed beyond the 0.4 km (0.25 mile) range. Timing restrictions would serve to minimize this impact, as described in the mitigation section.

The proposal would require removing habitat that may meet the definition of designated critical habitat for northern spotted owl and/or marbled murrelet. The habitat that would be removed

is not currently suitable for these species, and this impact could be mitigated by improving habitat or by other measures identified through informal consultation between the USFS and the USFWS, as required under the ESA.

Some sensitive wildlife species and habitats (i.e., those species of concern to the agencies but not protected under the ESA) would be impacted through habitat removal and temporary disturbance during construction. Impacts would be limited to the site of action, with negligible effects on local or regional populations. In other words, the proposal may impact individuals of species considered sensitive, but it is not likely to trend toward federal listing or loss of viable populations.

Northern Spotted Owl and Marbled Murrelet. Northern spotted owl and marbled murrelet nest sites would not be disturbed because:

- Construction would not take place within 0.4 km (0.25 mile) of nest sites or suitable nesting habitat during the nesting period unless approved by the USFWS (with U.S. Fish and Wildlife Service concurrence) as having no effect on spotted owls, on a case-by-case basis (see mitigation section).

- No nest sites or habitat suitable for nesting would be removed or otherwise altered (Dames & Moore 1997a).

The proposal would remove 0.74 ha (1.82 acres) of approximately 40-year-old western hemlock forest that may meet the definition of designated critical habitat for marbled murrelet. The impact would occur within an approximate 0.8 km by 9.1 m (0.5-mile by 30-foot) new corridor between the Annette Lake Trailhead area and the John Wayne Trail. While currently unsuitable for marbled murrelet nesting (using definitions identified in Hamer [1995]), this forest may meet the criteria of designated critical habitat due to the possible presence of: (1) forests with a canopy height of at least one-half the site-potential tree height within the pipeline corridor, and (2) potential nesting trees within 0.8 km (0.5 mile) of the pipeline corridor (as defined in the final rule for marbled murrelet critical habitat designation, 50 CFR Part 17 [Federal Register, May 26, 1996]).

The USFS will determine whether or not this habitat meets the definition through informal consultation with the USFWS under Section 7 of the ESA. Because the forest that would be disturbed is young and may not meet the minimum one-half site-potential tree height to qualify as critical habitat, it is reasonable to assume that this impact is not likely to affect designated critical habitat and could be readily mitigated through habitat improvements or other measures identified through informal consultation. However, maintenance of the 9.1 m (30-foot) corridor would preclude the future development of the 0.74 ha (1.82 acres) area into suitable habitat. Nevertheless, with mitigation, this impact would be negligible (see the mitigation section).

This same area between the Annette Lake Trailhead and the John Wayne Trail is within designated critical habitat for northern spotted owl. Because only immature trees (which provide little or no current habitat value for northern spotted owl) would be removed, immediate impacts would be minimal. However, over the long term, the 9.1 m (30-foot) maintenance corridor be maintained may reduce the value of the CHUs that would be crossed, including potentially increasing risk of predation to northern spotted owls using the area, once habitat in the surrounding forest becomes

suitable. Northern spotted owls are believed to be vulnerable to predation from great horned owls, which often occur along roads and other cleared ROWs, such as would occur with the project.

As described in the mitigation section, the value reduction of the CHUs could likely be offset by silvicultural prescriptions or other actions that may improve habitat values elsewhere within the CHUs, which could result in a net gain in habitat value within the CHUs. As is the case with designated critical habitat for marbled murrelet, this determination must be made through the ESA rather than through NEPA, since the USFWS must concur with the determination.

For impact disclosure and decisionmaking under NEPA, the permanent loss of habitat within the 30-foot-wide corridor is considered major without mitigation, since the impact may result in a significant adverse modification of designated critical habitat. With mitigation, the impact would be considered moderate. The actual damage of about 0.74 ha (1.82 acres) represents a small portion of a northern spotted owl's territory (territories are generally between 809 ha [2,000 acres] and 2,024 ha [5,000 acres] in size). Because of this, this damage would not likely affect viable populations of northern spotted owls either locally (i.e., within the CHUs) or within the population. However, as stated earlier, creation of a 30-foot-wide gap in habitat would result in a moderate increase in risk of predation to northern spotted owls that should eventually use this area.

Bald Eagle. No bald eagle nests would be disturbed because the proposal would not be within the 0.8 km (0.5-mile) maximum buffer recommended to protect bald eagle nests from disturbance (Rodrick and Milner 1991). Wintering bald eagles may be disturbed if work is conducted within 100 m (328 feet) of major water bodies from November 1 through March 15. These areas include the Snoqualmie River Valley, Tolt River, South Fork Snoqualmie River, Keechelus Lake, Yakima River, Columbia River, and lower Crab Creek. Timing restrictions and/or avoidance strategies recommended in the mitigation section would avoid these impacts.

The proposal may require the removal of potential perch trees along the Tolt and Yakima Rivers. This impact would be minor because perch trees in the areas that would be affected are relatively common, and the potential loss of these trees is not expected to substantially interfere with the ability of wintering bald eagles to feed or seek shelter. However, due to the federal threatened status of bald eagles, specific mitigation is recommended in the mitigation section to minimize this potential impact.

Construction activities, if conducted between November 1 and March 15 of any given year, may disperse waterfowl concentrations near the Columbia River. Waterfowl are an important food stock of bald eagles in the area. This impact is considered minor because the disturbance would be temporary and waterfowl are expected to continue to stay in the vicinity, with no notable reduction in bald eagle feeding abilities. Potentially, waterfowl disturbed by construction may be more vulnerable to capture by bald eagles, thereby increasing feeding ability, but this effect would likely be negligible, again because the impact would be temporary. Construction may not even occur during winter in this area, in which case construction of the pipeline would have no effect on wintering bald eagles along the Columbia River.

Gray Wolf and Grizzly Bear. Construction is not likely to adversely affect gray wolf or grizzly bear because these species are not substantial elements of the affected

environment. The proposal would not increase human presence or disturb habitat, in the context of the existing and past level of disturbance caused by I-90, recreation, and forestry. While individual grizzly bears or gray wolves could possibly wander into the area during construction and then be frightened off, the significance of such an event is minor because the impact would be temporary, would affect a transient individual, and would occur where existing human activities preclude the area from being an important use area.

Peregrine Falcon. Cliffs above the Columbia River contain potential peregrine falcon nest sites, although none have been reported there. Crossings and construction within any of the crossing options would disturb potential habitat. If construction occurred between February and July of any given year, then any nest sites present could be disturbed. Clearance surveys for peregrine falcon and other raptors would fully mitigate this potential impact (see mitigation section). The proposal would not cross any peregrine falcon nesting areas outside of the Columbia River zone, so no other impacts to peregrine falcon nest habitat would occur during construction.

No peregrine falcon foraging area would be significantly disturbed. Potentially, migrant and/or foraging peregrine falcons may be disturbed during construction, but such disturbance would be negligible, since peregrine falcons are very wide ranging and impacts would occur in a small area at any one time. No estuaries or mudflats (the preferred foraging areas of peregrine falcon in Washington) would be disturbed.

Sensitive Species. Several sensitive species may be impacted during construction. Impacts could include direct loss of nests or dens, disturbance of nest sites or dens leading to abandonment or reduced productivity, temporary displacement, and temporary and/or permanent habitat loss.

Should construction take place during the nesting season of sensitive species (generally April 1 through July 15 of any given year), then nest and/or den sites of sensitive and other species could be directly lost. This impact would not occur within the 45 km (28 miles) that would be constructed within existing roads or trails. Impacting nests would be considered a major impact because most birds are protected under the Migratory Bird Treaty Act and, therefore, are legally protected from "take," which includes destroying nests or eggs. This impact can be avoided by timing restrictions and/or clearance surveys, as described in the mitigation section.

Specific examples of sensitive species that could be disturbed include:

- Northern goshawks have been documented near Tinkham Road. Suitable habitat occurs near the pipeline corridor throughout USFS lands. No nesting habitat would be removed, but construction could lead to disturbance and/or reduced productivity of northern goshawks nesting nearby (within approximately 100 m [328 feet]). Impacts could be avoided by conducting clearance surveys and applying appropriate timing restrictions (see the mitigation section).

- Without mitigation, nesting prairie falcon, ferruginous hawk, and other raptors could be impacted during construction. Most impacts would be limited to disturbance, rather than

direct removal of nest sites. Impacts could be avoided by conducting clearance surveys and applying appropriate timing restrictions (see the mitigation section).

- Burrowing owls exist in the eastern portion of the project area, from approximately Kittitas to Pasco. Construction between March 15 and August 15 of any given year could disturb nesting burrowing owls and potentially destroy nesting burrows because complete inventories have not been recently conducted in the area. Disturbance during construction could be avoided through clearance surveys and timing restrictions, as described in the mitigation section.

- Long-billed curlews nest throughout the Columbia River Basin and may nest within or near the area proposed for construction. Disturbance during construction could be avoided through clearance surveys and timing restrictions, as described in the mitigation section.

- Sandhill cranes may be temporarily disturbed during construction in areas mapped by the WDFW as sandhill crane staging areas, should construction take place during the spring (early March through mid-May) and fall (mid-September to early November) migration period. Disturbance during construction could be avoided through timing restrictions, as described in the mitigation section.

Other known raptor nests near the proposal would not be disturbed because they are sufficiently far from where construction would occur. These include an osprey nest near Keechelus Lake (377 m [1,237 feet] distant), a turkey vulture nest near the South Cle Elum Ridge (700 m [2,296 feet] distant), and a Swainson's hawk nest east of Ellensburg (478 m [1,569 feet] distant).

Sensitive wildlife other than birds could be disturbed as well:

- Tailed frogs have been found near streams feeding Keechelus Lake and are assumed present on stream crossings 44 to 134, which are the rivers and streams with the cold, turbulent water favored by this species. In addition, Cascades frogs exist in and near wetlands and streams in the same vicinity. Crossing could cause temporary disturbance and some incidental mortality to these species; however, the overall effect of construction would be minor because only a minor fraction of habitat would be disturbed and the impacts would be temporary. Clearance surveys, as indicated in the mitigation section, would minimize potential mortality.

- Night snake and striped whipsnake occur near the Columbia River crossing. In addition, the pipeline corridor crosses habitat identified by the WDFW as important snake habitat on the eastern side of the Columbia River. The shrub-steppe habitat type identified as sagebrush/spiny hopsage/grasses by Dames & Moore (1997b) is also likely habitat for these species. The primary impact that could occur to these species, as well as other species, would be disturbance of hibernacula, which are dens where snakes communally gather over winter. However, the likelihood of this impact is low because hibernacula are generally widely dispersed. Risks of disturbance could be minimized through timing restrictions and/or clearance surveys conducted in coordination with the WDFW (see

mitigation section). Habitat loss and disturbance would be minimal because the proposal would not substantially alter key habitat components for these species.

- Washington ground squirrels occur in open grassland habitats from Vantage south to Pasco. Impacts cannot be avoided, although surveys of shrub-steppe and grassland areas containing burrows could be effective in identifying areas to avoid. Timing restrictions would be difficult for Washington ground squirrel. The species is generally either below ground and inactive, where they would be vulnerable to direct mortality during construction, or else they are breeding where breeding dens would be vulnerable to disturbance. Mitigation should be identified in cooperation with the WDFW (see mitigation section).

Priority Habitats. Construction would result in a moderate impact on shrub-steppe habitats. Approximately 0.8 ha (2 acres) of high-quality shrub-steppe habitat along the steep banks on the east side of the Columbia River would be impacted. No areas mapped as priority shrub-steppe habitat by the WDFW would be affected. In addition, because of the disturbed condition of 74 percent of the shrub-steppe habitats to be removed, most would not meet the WDFW definition of priority shrub-steppe habitat.

Cliff habitat along both sides of the Columbia River would be affected during construction. The impact is expected to be minor, in terms of actual habitat loss, because the linear path required by the proposal would take up only a very small fraction of available habitat and the resulting habitat within the pipeline corridor would likely provide habitat value similar to pre-project conditions. As with all habitats, construction within cliff areas during the breeding season could impact breeding wildlife, including nesting hawks and owls. This impact could be avoided by conducting clearance surveys and applying timing restrictions as necessary to prevent incidental disturbance of nest sites (see mitigation section).

Riparian habitat would be cleared in 9.1 m (30-foot) swaths at most stream crossings. The loss would be most notable in areas where riparian habitat contrasts sharply with adjacent upland habitats, such as where logging has removed adjacent forest or, as in many eastern Washington areas, riparian areas provide shrubby cover that contrasts sharply with the dry grassland and cropland of adjacent uplands. In these areas, more wildlife species depend on the riparian habitat for food, shelter, and breeding habitat, since adjacent uplands may lack key habitat requirements. Clearing and trenching across streams could expose soils to moving water, thereby eroding streambanks and jeopardizing restoration efforts. Mitigation measures for water resources and quality (Section 3.6) would serve to minimize this impact. While food, cover, and nesting habitat would take up to 50 years to replace, riparian habitat values would likely return within a few years of clearing, assuming that banks would remain stable. Overall, the impact on riparian habitat is considered moderate, because (1) it is considered an important habitat type, (2) only a small portion of any one riparian area would be removed, and (3) restoration of habitat values is expected except for within the 10-foot-wide corridor that would be kept in a low-growing vegetation type.

During construction, many wetlands would be trenched, as detailed in Section 3.4, Wetlands. Impacts would include temporary loss of vegetation, which in turn would reduce wildlife food and cover within affected wetlands. Loss of larger trees or snags (e.g,. greater than 20 cm [8 inches] in

diameter) would represent a long-term loss of habitat value, because trees are generally slow growing and take a long time to replace.

Within the Snoqualmie Valley, where several of the potentially impacted wetlands are located, habitat would be temporarily reduced for many wetland-associated species. This impact would be minor because only a small fraction of any one wetland would be disturbed and habitat values are expected to become reestablished within a few years.

Within the lower Crab Creek area, where many ponds and larger wetlands are major nesting and brood rearing areas for waterfowl, habitat loss may result in decreased breeding habitat and associated reductions in productivity for some affected wetlands. Assuming construction would not take place during the breeding season, this impact is considered minor because only a minor portion of available habitat would be disturbed, and the areas disturbed would be revegetated soon after project construction.

East of the Beverly-Burke Pump Station, the pipeline would cross several draws containing thickets of greasewood and other shrubs. Clearing within these areas would result in a moderate, temporary loss of breeding and shelter habitat for pheasants and other wildlife.

The proposal would require habitat removal within three areas designated as Natural Open Space: a forested hillside near the Tolt River, a habitat patch near Lower Babcock Ridge, and another habitat patch north of the Pasco Terminal. Loss of trees within the forested hillside near the Tolt River would result in long-term impacts, because trees take over 50 years to replace. Otherwise, habitat values would return with restoration, as proposed by OPL.

Only minor impacts would occur within the oak woodland crossed by the pipeline corridor near Swauk Creek, east of Cle Elum. The pipeline corridor would avoid the majority of oak stands, although a few (less than five) individual oak trees may be removed.

General Wildlife Species and Habitats. Should construction take place during the spring nesting season (generally April 1 through July 15 of any given year), nest and/or den sites of wildlife could be directly lost. This impact would not occur within the 45 km (28 miles) that would be constructed within existing roads or trails. Impacting nests would be considered a major impact because most birds are protected under the Migratory Bird Treaty Act and, therefore, are legally protected from "take," which includes destroying nests or eggs. This impact can be avoided by timing restrictions and/or clearance surveys, as described in the mitigation section.

Habitat Loss. Temporary habitat loss is the most direct impact that would occur to general wildlife communities. Construction would require full clearing, generally within the 18.3 m (60-foot) construction corridor. Wildlife habitats would be directly and completely removed by digging and grading within the central portions of the construction corridor, and somewhat less disturbed toward the edges of the construction corridor, where wildlife habitats would be incidentally damaged by vehicles, construction materials, and workcrews.

Approximately 41 percent (218 ha [540 acres]) of the wildlife habitat that would be lost would be within shrub-steppe, although only one stand of relatively undisturbed shrub-steppe habitat

would be impacted. About 26 percent of this cover type along the pipeline corridor contains mostly native shrubs and grasses and is expected to provide moderate to good wildlife habitat, especially during winter when food and cover are scarce. The temporary loss of these habitats represents a moderate impact because it could result in small-scale, localized population reductions for small mammals, game birds, and other wildlife due to reduced breeding success and/or increased winter mortality. The other stands of shrub-steppe that would be disturbed have a high amount of non-native species. Disturbance of these areas would have a minor impact on wildlife due to the existing reduced habitat values of these areas and relative abundance of similar habitats in the project vicinity.

OPL proposes to seed the construction corridor within shrub-steppe habitats using a native seed mix. However, restoration of pre-project communities may not be achievable without restoration plans that include specific restoration targets, the use of established plants, long-term monitoring, and periodic replanting in response to monitoring results (see mitigation section). With only seeding, the long-term impact could be to replace shrub-steppe habitats dominated by native species with those dominated by (1) non-native species, including cheatgrass, and (2) native but aggressive shrubs, such as rabbitbrush, which tend to quickly colonize disturbed areas within the shrub-steppe vegetation zone.

The second most affected cover type would be agricultural land (e.g., cropland, hay/pasture and orchard), of which 173 ha (432 acres) would be temporarily lost due to construction. This loss would represent a minor impact on wildlife because (1) these habitat types represent the most common habitat type available near where impacts would occur, (2) overall, these habitat types provide little value to wildlife other than a seasonal source of food and cover, and (3) wildlife species that would be affected are generally very common or even considered pest species (e.g., European starling and brown headed cowbird).

While shrub-steppe and agricultural lands are generally non-forested, patches of trees are present within these cover types. Because trees are rare east of the Yakima River, any patch of trees can provide breeding habitat and cover for birds and other wildlife. Many species of mammals may seek shelter from sun or inclement weather within forest groves. Even individual trees can be important shade or nest sites. Therefore, clearing of trees east of the Yakima River would be considered a moderate impact, and mitigation is suggested later in this chapter.

Scrub-shrub habitats, which occur in BPA transmission line easements and other areas where vegetation is controlled, represent 16 percent of the total vegetation impact (83 ha [207.6 acres]). This would have a moderate impact during construction, because these areas are used by numerous types of wildlife. However, over the long term, this impact would be negligible because this cover type can recover to pre-project conditions, in terms of habitat value, within 5 to 10 years.

Forest cover types represent 8 percent of the total vegetation impact (42 ha [104.3 acres]). Specific forest types that would be removed include second-growth western hemlock forest, deciduous forest, silver fir, Douglas-fir, mixed forest, and young coniferous forest. This impact, in terms of wildlife, would be relatively minor because these forested habitat types are relatively common, as are the species that inhabit them. Wildlife use of forests is generally lowest within "middle-aged" forest stands, such as most of those along the pipeline corridor. Wildlife use is generally highest within recent clearcut and within old-growth stands. Impacts within forested areas

would be similar to those that occur as part of commercial timber harvest. The Washington Department of Natural Resources routinely harvests second-growth forest throughout the state, and such actions are almost always permitted with a Determination of Nonsignificance under SEPA. However, the effects of habitat removal would be long term because much of the forest communities would not regrow to pre-project conditions until 50 or more years.

Construction Impacts - Columbia River Approach Options

Threatened, Endangered, and Other Sensitive Species and Habitats. The proposed route north of I-90, through Ginkgo State Park, would cross within approximately 180 m (591 feet) of a Swainson's hawk nest. Other nest sites may be present in the area as well. Burrowing owls and striped whipsnake are known to be within the vicinity of the northern YTC option. With mitigation, the impacts of the northern route would be minor. The southern YTC options do not cross any priority habitat identified by the WDFW, although environmental concerns for sensitive species would still apply. These options would also result in a minor level of impact, with mitigation.

General Wildlife Species and Habitats. A large portion of the route through Ginkgo State Park is outside of but adjacent to mule deer winter range identified by the WDFW, so timing restrictions may be necessary to avoid disturbing deer during winter. During severe winter conditions, when wintering deer are most susceptible to disturbance, construction would most likely be halted in this area due to logistical problems regardless of the presence of winter range, so this impact is not a major concern.

The northern YTC option would remove 9.3 ha (22.9 acres) of degraded shrub-steppe community, 1.4 ha (3.5 acres) of hay/pasture, and 1.1 ha (2.7 acres) of grass cover types. Overall, the difference results in a minor increase in habitat loss over the proposed pipeline corridor.

Construction Impacts - Columbia River Crossing Options

Threatened, Endangered, and Other Sensitive Species and Habitats. All of the Columbia River crossing options require construction within cliff habitat on both sides of the river. This habitat is used by nesting prairie falcons and other hawks, nongame birds, and diverse communities of reptiles, including striped whipsnake and night snake. The options do not differ substantially in impacts to sensitive animals, because similar types and amounts of habitats would be disturbed. Because cliff habitat is used by a variety of species, including many sensitive species, the impact of disturbing cliff habitat is considered moderate.

General Wildlife Species and Habitats. All of the Columbia River crossing options require construction within cliff habitat on both sides of the river. This habitat is used by birds and diverse communities of reptiles. The Burlington Northern Beverly Railroad Bridge crossing option would require 17 ha (42 acres) more shrub-steppe impact than the proposed pipeline corridor. This area is grazed and provides moderate habitat value for wildlife. Overall, the options do not differ substantially in impacts to wildlife, because similar types and amounts of habitats would be disturbed.

Operational Impacts - Overall Proposal

Threatened, Endangered, and Other Sensitive Species and Habitats.

ROW Maintenance. Overall, operation would have little effect on threatened, endangered, or sensitive wildlife species under normal conditions. The primary effect would be the long-term maintenance of the ROW through vegetation control, which would involve manual cutting of trees in forested parts of the pipeline corridor to allow aerial viewing of the corridor. Use of chainsaws during the breeding season of northern spotted owls, marbled murrelets, or other birds could disturb nest activities and reduce nest site productivity. In some cases, nests may be located in trees being removed. Clearance surveys and timing restrictions would minimize this potential impact (see mitigation section).

ROW Inspections. Ground patrols and aerial inspections would occur approximately every 2 weeks. Because most of the pipeline corridor would be adjacent to existing roads and cleared ROW, the additional human presence would have little or no effect on threatened, endangered, or otherwise sensitive species. Some areas may be sensitive to regular entry and/or low-level fixed wing airplane flights, including nest sites, deer and elk winter range, and the sandhill crane migration area in the lower Crab Creek area. Site-specific management plans, developed and implemented through consultations with the WDFW, would mitigate potential impacts to minor or negligible levels (see mitigation section).

Spills. Impacts of a spill are uncertain because the location and extent of a potential spill are unpredictable, except in terms of risk (see Appendix A, Spill Risk Information, and Section 3.18, Health and Safety). Refined product spills could impact wildlife through (1) physical contact, (2) toxic contamination, and/or (3) destruction of food resources.

Of the threatened, endangered, and other sensitive species within the affected environment, bald eagle, osprey, peregrine falcon, and all species of amphibians are most vulnerable to the effects of a spill. These species feed and/or live within and near rivers, streams, ponds, and lakes, where spilled product is most likely to collect. Bald eagles are carrion feeders; if they feed on fish killed by a spill, eagles may subsequently become ill or die. However, bald eagles may avoid fish tainted with sufficient product to harm the eagle. Ospreys also feed on fish, and could ingest contaminated fish and/or become contaminated themselves. Peregrine falcons are less likely to be affected by a spill because very few, if any, are located near the project. Amphibians are particularly susceptible to contaminants because their skin is permeable. Spills that contaminate amphibian-bearing waters are likely to kill some or all of the amphibians within the affected area. Cleanup operations could also impact wildlife habitat and disturb wildlife. This impact is also uncertain and cannot be fully predicted.

General Wildlife Species and Habitats. Impacts would be the same as those described above for special-status species.

Cumulative Impacts. The project would not cause significant cumulative impacts on threatened or endangered species. Loss of shrub-steppe habitat would be additive to the large amount of shrub-steppe habitat that has already been lost due to large-scale conversion of native habitats to

crop and range lands. The proposal would take place within areas that have already been significantly impacted by human activities, including roads, trails, commercial forestry, forest fires, and cleared utility corridors. The short- and long-term habitat loss associated with the project would be additive to these past and ongoing disturbances to wildlife and wildlife habitat. However, because of these past disturbances, the impacts of the proposal, considered individually, are lower in intensity because pristine habitats are not being disturbed.

3.5.2.2 No Action

None of the impacts from construction or normal operation of the proposal would occur. Because No Action would result in continuing use of trucks on the highway, it would result in a minor amount of additional highway mortality for wildlife. The frequency of expected spills from the combined increase of truck and barge traffic would likely exceed the frequency of pipeline spills. Although most spills from any of these sources would be minor, major spill volume could be released from barge or tanker ship under No Action, or from the pipeline, potentially totaling thousands of barrels. Threatened, endangered, and other sensitive species are at risk with or without the project, due to alternate transport modes. A tanker truck could spill 8,000 gallons of the same product (jet fuel, gasoline, or diesel) in many of the same areas that would be occupied by the proposed pipeline.

The No Action Alternative would remove no wildlife habitat, while the proposal would remove 524 ha (1,310 acres) during construction and maintain 67 ha (174 acres) in low-growing form during operation.

3.5.3 Additional Proposed Mitigation Measures

3.5.3.1 Construction Mitigation and Subsequent Impacts

The following mitigation measures focus on protection of important habitats and use areas for wildlife during construction. If applied, the following mitigation measures would reduce impacts of disturbance to minor or negligible. Where the term "avoid" is used, the impact would be essentially eliminated by the proposed mitigation measure. Where the term "minimize" is used, impacts may still occur, as indicated.

- Unless clearance surveys have been completed and accepted as sufficient by the USFWS, do not use blasting techniques within 1.6 km (1 mile) of (a) a known nest site for marbled murrelet and/or spotted owl, or (b) habitat that is potentially suitable for marbled murrelet, northern spotted owl, and/or peregrine falcon nesting, or (c) known or likely bald eagle winter use area from November 1 though March 15.

- To comply with the ESA and to mitigate impacts on threatened and endangered species, marbled murrelet CHUs, and northern spotted owl CHUs, conduct informal consultation with the USFWS, as specified under Section 7 of the ESA (see 50 CFR Part 402.12, Federal Register, June 3, 1986). To address CHUs, provide to the USFWS locations,

numbers, size, species, and specific area impacted within CHUs, along with other information that may be requested by the USFWS, including survey data if necessary. If necessary (as determined through consultation with the USFWS), develop and implement silvicultural prescriptions to offset value reductions caused by creation of the pipeline corridor.

- To avoid disturbing nesting northern spotted owl, prohibit construction within the range of the northern spotted owl during the nesting period (March 15 through August 1) anywhere suitable nesting habitat occurs within 0.4 km (0.25 mile) unless surveys have been completed according to USFS protocol and specific written authorization is provided by the USFWS.

- To avoid disturbing nesting marbled murrelets, prohibit construction within the range of the marbled murrelet during the nesting period (April 1 through September 15) unless specific written authorization is provided by the USFWS on a case-by-case basis. In addition, prohibit blasting anywhere within USFS lands during the marbled murrelet nesting season unless the USFWS concurs in writing that such blasting would not likely affect marbled murrelets. With mitigation, impacts on marbled murrelet would be negligible.

- To minimize disturbance of wintering bald eagles, do not conduct work within 100 m (328 feet) of the Snoqualmie River, Tolt River, South Fork Snoqualmie River, Keechelus Lake, Yakima River, Columbia River, or lower Crab Creek from November 1 through March 15 of any given winter unless clearance surveys are conducted daily to determine that no bald eagles are present within 100 m (328 feet) of construction activities (or 1.6 km [1 mile] from any blasting). In addition, identify potential perch trees that would be removed, including any trees greater than 30 cm (12 inches) in diameter at breast height. If perch trees regularly used by bald eagles are to be removed, then trees should be planted to eventually replace lost trees. With these two measures, impacts on wintering bald eagles would be minor to negligible, although specific measures and impact levels must be determined through consultation with the USFWS.

- To minimize disturbing or destroying nests or eggs of peregrine falcon, prairie falcon, ferruginous hawk, northern goshawk, and other raptors (e.g., red-tailed hawk), construction should not take place during the nesting season (March 15 to July 15) of any given year unless clearance surveys are conducted to demonstrate that no raptor nests are present within 0.4 km (0.25 mile) of construction areas. To prevent the taking of nests of other birds protected under the Migratory Bird Treaty Act, limit vegetation clearing to after July 15 and prior to March 15, unless clearance surveys are conducted within 3 meters (10 feet) of vegetation clearing areas. Survey protocols should be approved by designated USFS staff. With this measure, impacts on raptors and other birds listed under the Migratory Bird Treaty Act would be minor to negligible. Site-specific plans for nest site protection should be conducted in consultation with the USFWS and WDFW. Because peregrine falcons are federally listed as endangered, consultation with the USFWS under Section 7 of the ESA will be required prior to construction.

- To avoid disturbing nesting burrowing owls, conduct clearance surveys prior to construction from Kittitas to Pasco. In addition, curtail construction activities from March 15 through August 15 within 0.4 km (0.25 mile) of active nesting burrows (including accessory burrows). Should construction require burrows to be destroyed, do so outside of the nesting season (above). To minimize the impact, construct replacement burrows per WDFW direction. Replacement burrows have been shown to effectively mitigate for unavoidable loss of burrowing owl nesting areas. With this mitigation measure, the impact of removing a nest burrow would be minor.

- To avoid disturbing nesting long-billed curlews, conduct clearance surveys prior to construction from Kittitas to Pasco. Avoid construction within 100 m (328 feet) of nest sites during the breeding season. With this mitigation measure, the impact on long-billed curlews would be negligible.

- To avoid disturbing sandhill cranes, suspend construction activities within areas mapped by the WDFW as priority sandhill crane habitat during the spring (early March through mid-May) and fall (mid-September to early November) migration periods, unless specific clearance is provided by the WDFW, due to different use and timing patterns that may occur from year to year. With this mitigation measure, the impact on sandhill cranes would be negligible.

- To minimize incidental killing of tailed frogs, Cascades frogs, and other amphibians, conduct clearance surveys immediately prior to construction in wetland, stream, river, and riparian habitats and remove individuals from areas that would be disturbed. Destruction of amphibian eggs may be minimized by conducting clearance surveys and relocating any eggs found to suitable habitat. Storage and/or relocations of adults and/or eggs should be conducted in accordance with a mitigation agreement prepared in cooperation with the WDFW and as approved by the USFS and/or applicable land owner/manager. Continue surveys each day prior to construction. With this mitigation measure, the impact of potentially killing sensitive amphibians would be minor.

- To minimize risks of disturbing snake hibernacula, do not clear rocky areas from approximately October 15 through May 1 of any given year. Where such timing conflicts with timing restrictions to protect nesting raptors or other birds, coordinate with the WDFW and submit consultation letters to the USFS for review and approval. With this mitigation measure, the risk of potentially disturbing snake hibernacula would be minor.

- Mitigation for impacts on Washington ground squirrels should be identified in cooperation with the WDFW.

- To minimize disturbing or destroying nests or eggs of birds other than raptors protected under the Migratory Bird Treaty Act, construction should not take place during the nesting season (between March 15 and July 15) of any given year unless clearance surveys are conducted to demonstrate that no nests are present. Surveys should be conducted according to recognized USFS and/or WDFW protocols or, in the absence of established

protocols, survey protocols should be approved by designated USFS staff. With this measure, impacts on nesting birds would be minor to negligible.

- To ensure habitat values are replaced as part of restoration efforts, follow mitigation guidelines for Botanical Resources (Section 3.3). In addition, develop specific performance standards for restoration within each cover type that would be impacted and monitor for achievement of each standard. Performance standards would be approved by the USFS. Where monitoring indicates failure, plant additional vegetation or adjust methods/species as necessary to meet performance standards. Seeding would likely require some augmentation by planting established plants.

- To offset loss of cover in shrub-steppe and in agricultural lands, plant patches of shrubs within the ROW in adjacent parcels in cooperation with landowners. OPL could also coordinate with habitat restoration/improvement projects that may be ongoing near the pipeline corridor.

- Replace any trees removed east of the Yakima River with a 2:1 ratio of established nursery stock (5- to 10-year-old trees), using species acceptable to the WDFW. Conduct monitoring and maintain as necessary to ensure survival for 10 years.

- To prevent loss of riparian habitat values through erosion, follow mitigation measures identified in Section 3.6, Water.

- To minimize disturbance of wintering deer and elk, develop specific timing restrictions with WDFW. Timing restrictions may vary with weather conditions, so such restrictions would likely be made on a case-by-case basis.

- To minimize disturbance to roosting and/or breeding bats, conduct clearance surveys for bats prior to disturbing habitat within cliff areas. Establish appropriate timing restrictions should bat roosts/breeding areas be found within the impact corridor.

3.5.3.2 Operational Mitigation and Subsequent Impacts

- To avoid potential disturbance or removal of nest sites, tree cutting for maintenance of the ROW should not take place during the nesting season (March 15 to July 15) of any given year unless clearance surveys are conducted to demonstrate that no nests are present. Surveys should be conducted according to recognized USFS and/or WDFW protocols or, in the absence of established protocols, survey protocols should be approved by designated USFS staff. With this measure, impacts on nesting birds would be minor to negligible.

- To minimize the potential impacts on sandhill cranes, aerial and driving inspections of the pipeline corridor should be done so as not to disturb the flocks. To minimize potential impacts on wintering deer, do not drive through wintering range when snow cover averages greater than 0.61 m (2 feet). Develop and implement site-specific management

plans, in consultation with the WDFW and USFWS (for species listed under the ESA and/or Migratory Bird Treaty Act), to mitigate potential impacts of ground patrols and aerial inspections of the pipeline corridor. With these measures, impacts on cranes or wintering deer during operation would be minor or negligible.

3.6 WATER

3.6.1 Affected Environment

Water resources in the proposal area are discussed by physiographic provinces -- areas with characteristic climatic, geological, and topographical features that influence the timing, amount, and type of precipitation, which in turn influences hydrologic responses of surface water and groundwater. As indicated in Figure 3.6-1, the proposed pipeline would cross four physiographic provinces including the Puget Sound Lowlands, Western Cascade Mountains, Eastern Cascade Mountains, and the Columbia Plateau. Figure 3.6-2 illustrates the climatic and landform features of the four physiographic provinces and how they influence distinct streamflow responses.

3.6.1.1 Surface Waters

State stream channel and water quality classifications are indicators of the type and value of beneficial uses, or potential beneficial uses, of individual streams. The Washington Department of Natural Resources (WDNR) classifies individual stream channels as Types 1 through 5 as follows:

- Type 1 - All waters within their ordinary high-water mark with "shorelines of the state" designations.

- Type 2 - Segments of natural water which are not classified as Type 1 water, have a high use, and are important from a water quality standpoint for domestic water supplies, recreation, and fishery habitat.

- Type 3 - Segments which are not classified as either Type 1 or 2 but have a moderate to slight use and are moderately important for the uses identified for Type 2 water.

- Type 4 - Significant tributaries to Type 1, 2, or 3 waters that may be perennial or intermittent.

- Type 5 - All other waters in natural watercourses with or without well-defined channels; areas of perennial or intermittent seepage, ponds, and natural sinks.

State water quality standards (WAC 173-201A) classify waters based on their beneficial uses (e.g., water supply, stock watering, fish and shellfish, wildlife habitat, recreation, and commerce and navigation). Specific water quality standards apply to the following classifications of water bodies: Class AA (extraordinary - must markedly and uniformly meet requirements for all or substantially all beneficial uses); Class A (excellent - must meet or exceed requirements for all or substantially all beneficial uses); Class B (good - must meet or exceed requirements of most beneficial uses); and Class C (fair - must meet or exceed requirements of selected beneficial uses). If waters of a specific classification fail to meet requirements, they are termed “water quality limited”. The Washington Department of Ecology (Ecology) publishes a listing of water quality limited waters (Section 303(d)

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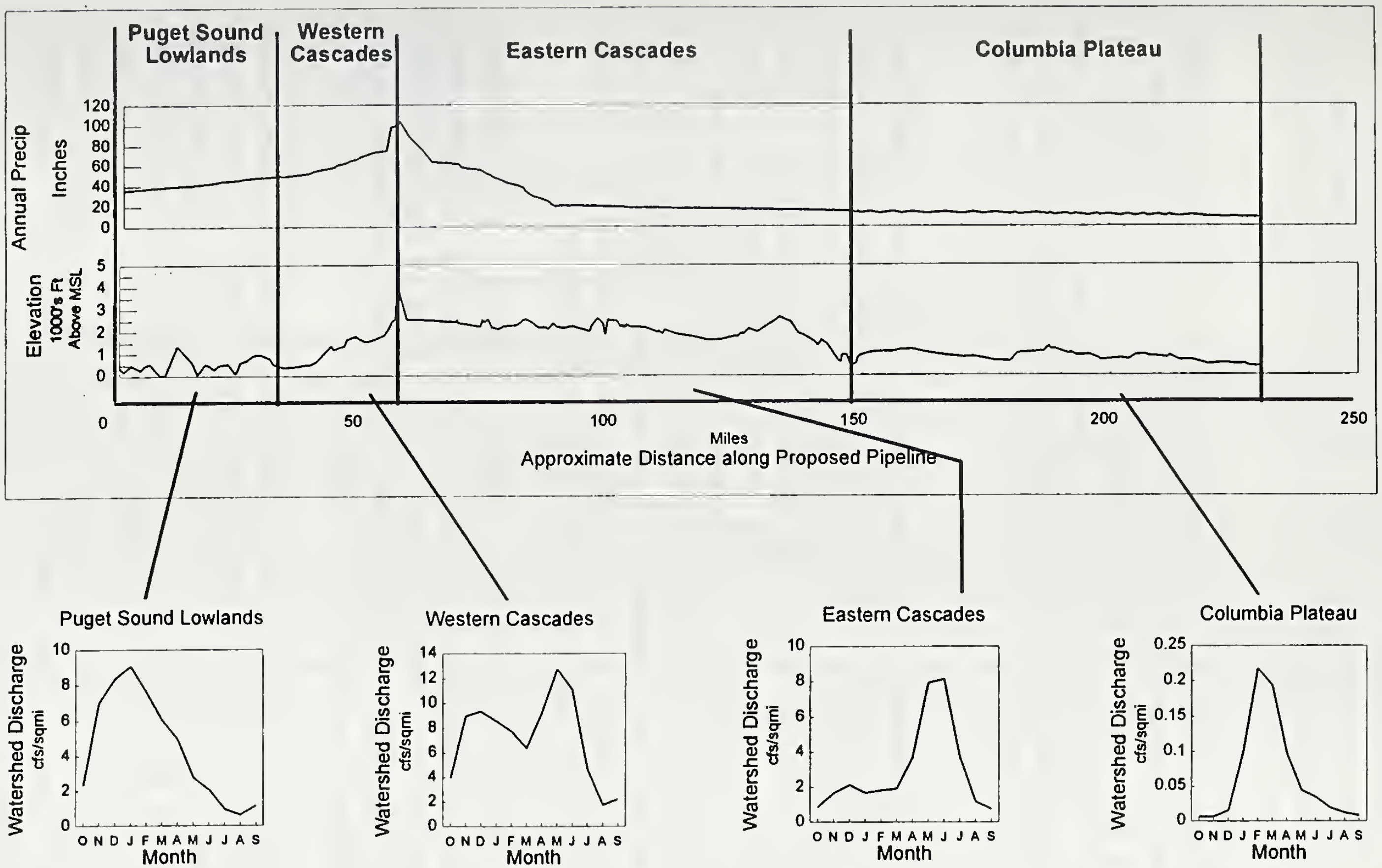
PHYSIOGRAPHIC PROVINCES AND WATER RESOURCE INVENTORY AREA (WRIA) BOUNDARIES

10 0 10 20 30
miles

Cross Cascade Pipeline
Washington
FIGURE 3.6-1



Precipitation and elevation data are general representations of data contained in the ASC (Dames & Moore, 1997) and this figure should not be used for precise estimates. Typical hydrographs are developed from mean monthly discharges of unregulated streams in cfs divided by the watershed area in square miles to provide a basis for comparison between provinces. Hydrographs of managed systems (e.g., for irrigation) differ. Hydrograph data is obtained from USGS (1992) for the Raging River (Puget Sound Lowlands), South Fork Snoqualmie River (Western Cascades), American River (Eastern Cascades), and Crab Creek (Columbia Plateau).

CLIMATE AND LANDFORM FEATURES OF PHYSIOGRAPHIC PROVINCES BISECTED BY PROPOSED PIPELINE, AND TYPICAL RUNOFF PATTERNS OF NATURAL STREAMS DRAINING LAND WITHIN THOSE PROVINCES

Cross Cascade Pipeline
Washington
FIGURE 3.6-2

list) that require additional protection to prevent further degradation. Ecology also permits and enforces water rights for the protection of water use and maintenance of instream flows.

Water resources in the proposal area are discussed below by Water Resource Inventory Areas (WRIAs) within each physiographic province. WRIAs are basin-scale water management areas used by the State of Washington. Proposed stream crossing location numbers are in parentheses and can be cross-referenced to Appendix D and the map atlas in the ASC. Surface water characteristics along the pipeline corridor are summarized in Table 3.6-1.

Puget Sound Lowlands Province. Approximately 53 km (33 miles) of the pipeline corridor lies within the Puget Sound Lowlands Province. The Puget Sound Lowlands includes the Cedar-Sammamish Basin (WRIA 8) and a portion of the Snohomish River Basin (part of WRIA 7). Within the Puget Sound Lowlands Province, WRIA 8 includes crossings 1 to 5 and WRIA 7 includes crossings 7 to 37. There are 5 channel crossings in WRIA 8 and 29 crossings in WRIA 7 within the Puget Sound Lowlands Province. Crossings 6, 8, 21, 25 and 30 are wetlands and crossings 12 and 33 were avoided.

Precipitation in WRIA 8 falls primarily as rainfall and generates peak flows in late fall and winter. Mean annual precipitation ranges from 64 to 97 cm (25 to 38 inches). The corridor would cross Little Bear Creek (1) and four tributaries (2, 3, 4, and 5). Little Bear Creek, a Type 2 channel, is approximately 6 m (20 feet) wide with bank stability and sediment deposition concerns. It lies in a floodplain with dense alder, shrubs, and conifers. The corridor would intersect the 100-year floodplain for a distance of about 54 m (177 feet). Little Bear Creek is managed for Class AA waters; however, it is water quality limited due to high fecal coliform levels. Proposed crossing 4 is a 3 m (10-foot) wide, steep confined Type 3 stream; the others are Type 4 and Type 5 channels. Within WRIA 8, 18 water rights have been issued near the pipeline corridor, primarily from wells or small creeks. Little Bear Creek, however, is closed to consumptive appropriations.

Smaller watersheds generally west of North Bend in WRIA 7 are similar in their hydrologic character to WRIA 8. Precipitation increases to approximately 127 cm (50 inches), and storm runoff generates late fall and winter peak flows. The pipeline corridor would cross 26 channels with this flow regime in WRIA 7, including six Type 1 channels, one Type 2 channel, and seven Type 3 channels. The remaining channels are Type 4 and Type 5 waters.

The lower Snoqualmie River crossing (11) and the Tolt River crossings (26 and 27) are discussed in the following section because much of their watershed lies within the Western Cascade Province and is influenced by the annual hydrology in that province. Other Type 1 channels include Cherry Creek (20), Griffin Creek (28), and Tokul Creek (34). Cherry Creek (20) is 16 m (52.5 feet) wide with bank stability and steep sideslope concerns. Griffin Creek (28) is 4.9 m (15.7 feet) wide where the pipeline corridor would cross. Tokul Creek (34) is a high-gradient (6.7 percent) channel with stable banks at the proposed crossing. Harris Creek (22) is a Type 2 stream 7.9 m (25.6 feet) wide with moderately erodible banks.

Table 3.6-1. Surface Water Characteristics Along the Proposed Pipeline Corridor

WRIA[1]	Physio Provences[2]	100-year Floodplains[3]		Water Quality Concerns[4]			Instream Flow Limitations[5]		Water Rights[6]
		Name	Length (Feet)	Name	Rating	Limiting Factors	Name	Limitation	Permits Issued
8	PSL	Little Bear Cr (1)	177	Little Bear Cr (1)	AA	Fecal	Little Bear Cr (1)	Closed	18
7	PSL, WC	Snoq R (11)	498	Snoq R (11)	A	Temp, Fecal	Snoq R (11)	Min. low flow 800 cfs	149
		NF Cherry Cr (19)	337	Cherry Cr (20)	A	Fecal	NF Cherry Cr (19)	No diversion at flows < 1 cfs	
				Griffin Cr (28)	A	Fecal			
		Tolt R (26, 27)	1,165	Tokul Cr (34)	A	Temp	Cherry Cr (20)	Min. low flow 120 cfs; normal flows maintained	
		Snoq R (38)	257	Snoq R (38)	A	Fecal, D.O., Temp	Harris Cr (22)	Closed	
		SF Snoq R (42, 43)	No Data				Griffin Cr (28)	Closed	
							Snoq R (38)	Min. low flow 600 cfs	
39	EC	Keechelus Lake	No Data	Big Cr (127)	AA	Temp	None	Currently under adjudication	453
		Cabin Cr (117)	412	Yakima R (147)	A	Temp, D.O.			
		Big Cr (127)	535	Swauk Cr (151)	A	Temp			
		Little Cr (129)	763	Wilson Cr (187)	A	Temp, Fecal			
		Yakima R (147)	832	Cooke Cr (199)	A	Temp, D.O., Fecal			
		Swauk Cr (151)	467						
		Currier Cr (177, 180)	417						
		Wilson Cr (187)	147						
		Naneum Cr (190, 193)	125						
		Coleman Cr (196)	799						
		Cooke Cr (199)	720						
		Caribou Cr (200)	23						
		Parke Cr (201, 205, 206, 1-A)	1,810						

Table 3.6-1. Continued

WRIA[1]	Physio Provences[2]	100-year Floodplains[3]		Water Quality Concerns[4]			Instream Flow Limitations[5]		Water Rights[6]
		Name	Length (Feet)	Name	Rating	Limiting Factors	Name	Limitation	Permits Issued
40	EC	Columbia R. (223)	1,150	None	n/a	n/a	Columbia R (223)	Min. low flow 10,000 cfs	6
41	CP	Lower Crab Cr (H26-C,D,E)	No Data	Lower Crab Cr (H26-C,D,E)	B	Temp, pH, pesticides	None	regulated for irrigation	61
				Crab Cr Lateral (237)	B	Temp			
36	CP	Esquatzel Coulee (284)	1,039	Esquatzel, Coulee and Canal (284, 283)	n/a	Temp, pH, D.O.	None	n/a	135
33	CP	None	n/a	None	n/a	n/a	None	n/a	26

Notes:

[1] Water Resource Inventory Areas (WRIAs) are displayed in Figure 3.6-1. Numbers represent management basins: Cedar-Sammamish River Basin (8); Snohomish River Basin (7); Upper Yakima River Basin (39); Alkali-Squilchuck Basin (40); Lower Crab Creek Basin (41); Esquatzel Coulee Basin (36); and the Lower Snake River Basin (33).

[2] Physiographic Provinces are displayed in Figure 3.6-1. Provinces are: Puget Sound Lowlands (PSL); Western Cascades (WC); Eastern Cascades (EC); and the Columbia Plateau (CP).

[3] Data from FEMA flood insurance maps and the ASC.

[4] Water quality ratings are described in 173-201A WAC and in the text. Impaired streams are identified in Ecology's 1996 303[d] list submitted to EPA.

[5] Instream flow limitations for WRIAs 7 and 8 are published in WAC 173-507 and WAC 173-508, respectively. A "Closed" limitation means the stream is closed to additional consumptive water diversion.

[6] Water rights permits issued by Ecology in the WRIAs *adjacent to the proposed pipeline alignment*. Permits may be for streams, springs, and wells and for a variety of beneficial uses.

All named streams in WRIA 7 in the Puget Sound Lowlands Province are managed for extraordinary (AA) or excellent (A) water quality. However, Cherry Creek (20), Griffin Creek (28), and Tokul Creek (34) are limited at the proposed crossings by fecal coliform or temperature exceedences, and are identified as impaired in the state's 1996 303(d) listing.

A 100-year floodplain is documented adjacent to the crossings of North Fork Cherry Creek. Small floodplains and floodprone areas may occur at some crossings and would need to be addressed during permitting.

Instream flow regulations limit withdrawals of surface water on North Fork Cherry, Cherry, Harris, and Griffin Creeks. Water rights holders along the pipeline corridor in this portion of WRIA 7 include the Cities of Carnation and Snoqualmie.

Western Cascade Mountains Province. From the second Snoqualmie River crossing (38) eastward to Snoqualmie Pass (just beyond crossing 84), 37 km (23 miles) of the pipeline corridor would lie in WRIA 7 and the Western Cascade Mountains Province. Precipitation in this province increases with elevation in the Cascade Mountains and western foothills. Mean annual precipitation in Snoqualmie Pass is approximately 267 cm (105 inches), but precipitation may reach 457 cm (180 inches) in adjacent watersheds draining westward from the divide. The annual hydrograph shows two peak flow seasons -- one in late fall from rainfall and one in spring from snowmelt. Because large portions of their watersheds lie within the Western Cascade Mountains Province, the lower Snoqualmie River crossing (11) and the two Tolt River crossings (26 and 27) are positioned within the Puget Sound Lowlands Province but retain this twice-seasonal peak flow characteristic. Rain-on-snow events can augment both runoff seasons with torrential flood events which scour channels in this province.

The pipeline corridor would intersect 51 channels in WRIA 7 which are in the Western Cascades Province (38 through 84). Three additional crossings reported in this province are actually wetlands (79, 80, 81) and one crossing is avoided (84). Six of the 51 channels (12 percent) are Type 1 and Type 2 streams. Type 3, Type 4, and Type 5 streams compose 24 percent, 33 percent, and 30 percent, respectively. Nine proposed channel crossings in this province (18 percent) have potential streambank and sediment deposition concerns. There are 32 steep confined and steep unconfined channels. Thirteen of these lie in or near areas with high mass wasting potential, underscoring the sideslope stability and deep scouring concerns associated with these channels.

The proposal would cross six channels in WRIA 7 with large, 100-year floodplains for a total corridor length in floodplains of approximately 0.8 km (0.5 mile). These include the Snoqualmie and South Fork Snoqualmie Rivers (11 and 38, and 42 and 43, respectively), and the Tolt River (26 and 27). Smaller floodplains and floodprone areas may occur adjacent to channels at some crossings and would need to be addressed during final project design.

All named streams in the portion of WRIA 7 where the pipeline would be located are managed for extraordinary (AA) or excellent (A) water quality. However, the downstream and upstream crossings of the Snoqualmie River are identified as impaired in the state's 1996 303(d) listing.

Instream flow regulations limit withdrawals of surface water from the Snoqualmie River, including near the two crossings. A total of 149 water rights have been issued in WRIA 7 adjacent to the pipeline corridor (including Western Cascade Mountains and Puget Sound Lowlands Provinces), including creek, spring, and well sources. North Bend is a municipal water rights holder in the Western Cascade Mountains Province.

Eastern Cascade Mountains Province. Sections of the pipeline corridor in the Upper Yakima River Basin (WRIA 39) and the Alkali-Squilchuck Basin (WRIA 40) fall within the Eastern Cascade Mountains Province. The pipeline corridor traverses nearly 147 km (92 miles) in this province, including 124 km (77 miles) of the Upper Yakima River Basin. There are 135 channel crossings in WRIA 39 (crossings 85 to 1-K) and 10 channel crossings in WRIA 40 (crossings 1-D to 23-A).

From Snoqualmie Pass (85) to Tillman Creek (133), near Cle Elum, the mean annual precipitation can exceed 254 cm (100 inches) and peak runoff occurs during fall rainstorm and spring snowmelt (similar to west slope conditions). Between Tillman Creek and Parke Creek (to crossing 1-K), mean annual precipitation declines to approximately 25 cm (10 inches). Peak flows in the larger channels in this portion of the basin correlate to spring snowmelt, and spring rain-on-snowmelt events in particular. However, the Yakima River is regulated by several reservoirs for irrigation, and the flow is shifted more into the summer months.

The pipeline corridor would cross 135 channels in the Upper Yakima River Basin. Mill (86), Cold (88), Roaring (97), and Meadow (99) Creeks and 11 other unnamed tributaries discharge to Keechelus Lake. All other streams that would be crossed, with the exception of 18 proposed irrigation canal crossings, flow into the Yakima River or its tributaries. Only six of the 135 channels (5 percent) in WRIA 39 are Type 1 and Type 2 streams, and 12 (8 percent) are Type 3 streams. The remaining streams are Type 4 and Type 5.

Low-gradient channels with potential streambank and sediment deposition concerns would be crossed at 25 locations (19 percent), including the Yakima River (crossing 147). Six of these meandering streams are braided or lie on alluvial fans where streambank disturbance can exacerbate lateral migration of the channel. There are eight steep confined channels, four of which have sideslope erosion and downcutting concerns.

Another 30 steep unconfined channels may be prone to channel avulsions and localized bed scouring. One-sixth to one-third of the 135 Upper Yakima River Basin channels are considered minor channels, generally less than 0.6 m (2 feet) in width and with flows that enable only incidental sediment and debris transport.

A total of 2.1 km (1.3 miles) of the pipeline corridor would be located within 100-year floodplains within WRIA 39. The longest of the 12 floodplains crossed would be adjacent to Parke Creek (crossings 201, 205, 206, and 1-A) and is about 0.55 km (0.34 mile) in length. The Yakima River floodplain contains about 254 m (832 feet) of the pipeline corridor. Smaller floodplains and floodprone areas may occur adjacent to channels at some crossings and would need to be addressed during final project design revisions.

All named streams along the pipeline corridor within the Upper Yakima River Basin are managed for extraordinary (AA) or excellent (A) water quality. Big Creek (127), Cooke Creek (199), Yakima River (147), Wilson Creek (187), and Swauk Creek (151) crossings are limited in the 1996 303(d) listing.

There are 453 water rights permits in WRIA 39 in the vicinity of the pipeline corridor, including all named streams. However, senior water rights and instream flow requirements are now under adjudication in WRIA 39 due to the over-allocation of available water. Kittitas County PUD and the City of Cle Elum hold water rights for municipal uses.

The Alkali-Squilchuck Basin (WRIA 40) lies within the Eastern Cascade Mountains Province as it transitions to the Columbia Plateau at the Columbia River. Approximately 23.4 km (14.5 miles) of the pipeline corridor would lie within this basin. Ten of the 11 streams crossed in this WRIA are small and intermittent, or they may be ephemeral, flowing only in response to storm events. Spring rains and snowmelt generate peak flows in early to mid-spring, earlier than in the upper Yakima River WRIA and later than in the Columbia Plateau Province. The Columbia River, which is also included within this WRIA discussion, functions as the Alkali-Squilchuck Basin's eastern boundary. The Columbia River (223), designated under shorelines of the state, is a Type 1 water. All other stream channels to be crossed within WRIA 40 are Type 4 or 5.

Most channels in this WRIA are incised in small to large canyons with little room for development of floodplains. The Columbia River is floodprone below an elevation of about 150 m (500 feet). Approximately 350 m (1,150 feet) of the pipeline would lie within the 100-year floodplain of the Columbia River (including Getty's Cove).

The Columbia River is managed for Class A water quality standards. All other surface waters that the pipeline would cross are not classified, and therefore Class A water quality standards would apply. None of the other channels has been identified as water quality limited.

There are six water rights permits issued within this WRIA adjacent to the pipeline corridor. These are groundwater rights used for water supply and irrigation. None of the surface waters have instream flow limitations, except the Columbia River, which has an instream flow requirement of at least 280 cubic meters per second (m^3/s) or 10,000 cubic feet per second (cfs). No municipalities obtain water from this portion of the Alkali-Squilchuck Basin.

Alternative alignments that have been identified at the Columbia River would cross primarily unnamed channels similar in structure and hydrology to those the proposed route would cross. Most are intermittent or ephemeral, Type 4 channels that could have some bank and sideslope stability concerns. None of these streams are classified by Ecology, thus they would be managed as Class A waters.

Columbia Plateau Province. Sections of the proposed and alternative alignments between the Columbia River and its terminus at the Snake River (crossings 224 to 285) are in the Columbia Plateau Province. About 133 km (82 miles) of the pipeline corridor would pass through the three WRIAs located in this province, including the Lower Crab Creek Basin (WRIA 41), Esquatzel Coulee Basin (WRIA 36), and Snake River Basin (WRIA 33).

Over 61 km (38 miles) of the pipeline corridor lies within the Lower Crab Creek Basin (WRIA 41). Mean annual precipitation is approximately 18 to 25 cm (7 to 10 inches) in this semi-arid region. Stream channels are sparse and usually intermittent. Peak flows occur in late winter or early spring in response to snowmelt or rain-on-snow events. Flow in lower Crab Creek is regulated by management of the Potholes Reservoir, and many upstream diversions exist for irrigation. Canals allow water transmission into and out of the basin across watershed divides. Much of the flow in lower Crab Creek is actually return flow from irrigated fields.

The pipeline corridor would cross 30 channels (crossings 224 to 254) in WRIA 41, nearly half of which are irrigation canals. Crab Creek, the primary natural drainage in this WRIA, is a sand-bedded, meandering channel. It is a Type 2 stream at each of its three proposed crossings (H-26C, H-26D, and H-26E). Most of the other 11 natural channels are Type 4 and Type 5 waters. Two of the channels lose their definition in wetlands at the pipeline corridor crossing. The canals are excluded from the state's stream typing system. Diversionary canals along the pipeline corridor include the Royal Branch Canal (233 and 235) and the Crab Creek Lateral (237).

Seven of the 14 proposed natural channel crossings are meandering streams; the remaining seven are minor streams. The three meandering lower Crab Creek crossings and two meandering tributaries (230 and 239) are generally well-vegetated and stable, but have high potential for bank and sideslope erosion because they are composed of sandy soils. Lower Crab Creek is managed for Class B water quality. The proposed pipeline corridor crossings, however, are located in water quality limited sections (temperature, pH, and pesticides) of the creek.

A total of 61 water rights have been issued in this WRIA adjacent to the pipeline corridor. Only six of these are for spring or creek withdrawals, however. Municipal water rights are held by Royal City and Grant County PUD.

Approximately 60 km (37.4 miles) of the pipeline corridor lies within the Esquatzel Coulee Basin (WRIA 36). Mean annual precipitation in this WRIA is 18 to 25 cm (7 to 10 inches). Streams are sparse and usually intermittent. Flow in the Esquatzel Coulee originates primarily as irrigation water diverted from the Columbia River at Grand Coulee Dam. In the vicinity of the pipeline corridor, Esquatzel Coulee carries irrigation return flows, much of which is diverted through the Esquatzel Diversion Channel and discharged back into the Columbia River upstream of Pasco. Peak flows in these irrigation channels occur between July and October. Approximately 317 m (1,039 feet) of the pipeline corridor lies within the 100-year floodplain of Esquatzel Coulee. Esquatzel Coulee and the Esquatzel Diversion Channel are managed as Class A waters. The Esquatzel Coulee and Canal are listed as water quality limited for temperature, pH, and dissolved oxygen.

The pipeline corridor would cross 30 channels within WRIA 36 (crossings 255 - 284), 25 of which are irrigation canals. A number of the canals are concrete-lined for at least a portion of their length. The Type 1 stream Esquatzel Coulee, which naturally meandered and downcut into the land before channelization, is concrete-lined at crossing 284. A Type 3 stream channel near Eagle Lakes is steep and confined with sideslope erosion concerns (262). Three other minor channels are Type 5 streams.

There are 135 water rights issued in this WRIA adjacent to the pipeline corridor. Most of these utilize well sources, including Basin City, the only municipal supplier with wells close to the pipeline corridor. No channels in the Esquatzel Coulee Basin have instream flow regulations to limit surface water withdrawals.

The pipeline corridor would lie within about 11 km (6.8 miles) of the Snake River Basin (WRIA 33). Mean annual precipitation in this area is approximately 15 cm (6 inches). Few channels develop in this semi-arid environment, and the pipeline corridor would cross only one -- an irrigation canal (285). The pipeline corridor terminates on the north bank of the Snake River, just upstream of its confluence with the Columbia River. The pipeline corridor would not cross any floodplains or water quality limited streams. However, the lower Snake River is currently on the state 303(d) list for pH limitations.

3.6.1.2 Groundwater

Groundwater quantity and quality are protected in the State of Washington. Groundwater quantities are protected by surface water and groundwater rights, and groundwater quality standards are defined in WAC 173-200. Groundwater is used for municipal, domestic, irrigation, and other uses along the entire pipeline corridor.

Groundwater conditions along the pipeline corridor are highly variable depending on the geology, hydrology, and climate. The occurrence and depth to groundwater is a function of climatic conditions and the permeability of overlying soils and geologic strata. Aquifers along the pipeline corridor occur in various geologic formations including recent alluvial deposits near large rivers and streams, glacial drift, fractured bedrock of the Cascade Mountains, and thick sequences of layered basalt and interbedded sediments in eastern Washington.

Groundwater recharge along the pipeline corridor is primarily by direct infiltration of precipitation and snowmelt. Groundwater recharge also occurs in floodplain areas during high water events. Recharge may also originate from small streams and water bodies that lose water to the underlying sediment. Groundwater recharge occurs at varying rates depending on the permeability of soil, climatic conditions, vegetation, slope, aspect, and degree of development.

The following discussion of groundwater conditions along the pipeline corridor highlights groundwater resources within the four principal physiographic regions and provides details of the Cross Valley Sole-Source Aquifer because of its regulatory status and importance as a resource. Characteristic groundwater regimes are described in Table 3.6-2. Refer to the map atlas in the ASC for specific locations of groundwater resources discussed in this section.

Cross Valley Sole-Source Aquifer. The Cross Valley Sole-Source Aquifer was designated by EPA in 1987. This sole-source aquifer, which supplies water for over 8,000 people, occupies an area of approximately 93 km^2 (36 square miles) in southcentral Snohomish County. The aquifer area is bounded on the east and north sides by bedrock, which is at or near land surface on the steep bluffs above the Snohomish and Snoqualmie Rivers, on the west by the North Creek Valley, and on the south by approximately the King/Snohomish County line.

Table 3.6-2. Aquifer Types and Associated Issues of Concern

Groundwater Regime	Soil Type	WRIA	Characteristics	Issues and Concerns	Monitoring/Mitigation*
I	Alluvium	7, 8, 33, 36, 39, 40, 41	Typically shallow water table associated with surface water bodies and floodplains. Well yields moderate to high, supporting public and domestic supplies. Variable sediment types. Provides baseflow to streams and rivers. Limited extent.	Shallow water table subject to contamination. Risk of contaminants spreading and entering surface water bodies and wells. Dewatering during construction may be necessary. Pipeline corrosion protection would be necessary.	Pipeline design features to minimize risk of leak (e.g., welded high-strength coated pipe, cathodic protection, block valves). Computerized leak detection system, regular visual inspections, internal inspections, and regular maintenance. ***Flow barriers of similar or lower permeability to surrounding soil should be located in the trench at stream crossings.***
II	Glacial Deposits	7, 8, 39	Variable water table depths. Multilayered aquifer, confined and unconfined conditions. Well yields can be substantial, supporting public and domestic supplies. Limited extent. Provides baseflows to rivers and streams.	Risk of contamination in shallow zones with subsequent spreading to water table and surface water. Dewatering may be necessary in areas of shallow groundwater.	Same as for alluvium where shallow groundwater is encountered.
III	Cascade Bedrock	7, 11, 39	Deep water table, often associated with fracture zones. Very limited in extent. Generally does not support water supplies.	Lower risk of contamination from spills; however, groundwater cleanup is impractical. Trench could serve as preferential pathway.	Flow barriers will be located in the trench at stream crossings and trench backfill will be of similar or lower permeability as the surrounding soils.
IV	Loess/Dune Deposits	33, 36, 39?, 40, 41	Variable water table depths; however, typically deep. Poor well yields generally do not support water supplies. Limited aquifer extent. Slow groundwater movement.	Same as above.	Same as above.
V	Outburst Flood Deposits	33, 36, 39, 40, 41	Water table generally shallow, although can be deeper in upland areas. Aquifers are associated with streams and rivers providing baseflows. Large yield supporting public and domestic supplies. Rapid transport. Limited extent.	Same as alluvium and glacial deposits.	Same as alluvium and glacial deposits.

Table 3.6-2. Continued

Groundwater Regime	Soil Type	WRIA	Characteristics	Issues and Concerns	Monitoring/Mitigation*
VI	Lacustrine Deposits	7, 8, 39	Water table depth variable. Low yields to wells.	Risk of contamination and pipeline corrosion in shallow groundwater zones. Trench may serve as preferential pathway for groundwater movement. Dewatering during construction may be necessary.	Same as alluvium and glacial deposits.
VII	Columbia River Basalt	33, 36, 39, 40, 41	Aquifers typically deep, exhibiting confined (artesian) conditions. Aquifers are regionally extensive. Groundwater transport rapid. Groundwater supports public, domestic, and irrigation wells. Well yield can be high.	Risk of contamination through well bore holes possible during spills. Spread could be considerable.	Conduct surveys to determine proximity of wells to pipeline alignment. ***Place flow barriers in trench at stream crossings.***
VIII	Sole-Source Aquifers (Cross Valley Aquifer)	7, 8	Aquifer is located in a glacial-fluvial sand deposit, underlying glacial till ranging in thickness from 25 to 100 feet. The aquifer is recharged via infiltration through the capping till layers.	Risk of contamination from oil leaks.	Pipeline design features to minimize risk of leak (e.g., welded high-strength coated pipe, cathodic protection, block valves). Trench lining would be used in sensitive areas to direct spills toward a lower sensitivity area for capture and cleanup. Computerized leak detection system, regular visual inspections, internal inspections, and regular maintenance. If studies show additional measures are necessary, include extra pipe wall thickness, additional localized cathodic protection, additional pipe joint inspection prior to coating, and additional block valves.

* Items in regular typeface are based on OPL 1998, Application for Site Certification. Items in ***bold italic*** are additional mitigation suggested by the EIS team.

Source: OPL 1998 and work by EIS team.

The Cross Valley Aquifer is located within a regionally extensive, heterogeneous sand and gravel layer ranging in thickness from less than 7.6 m to greater than 30.5 m (25 to 100 feet). The aquifer is primarily composed of Vashon-aged advance outwash sand and gravel often referred to as the Esperance Sand. The formation is capped by as much as 30 m (100 feet) of low-permeability glacial till, averaging 15 m (50 feet) in thickness in most places (Newcomb 1952). The till is absent in a number of locations along the pipeline corridor.

The aquifer is recharged by precipitation that infiltrates through the till or directly into the aquifer where the till is absent. Recharge is slow through the till layer, with infiltration rates often less than 0.3 m (1 foot) per day. Some wetlands, ponds, and lakes on top of the till over the aquifer also provide recharge to the aquifer. Infiltration is much more rapid through the outwash deposits. Additionally, because the till layer has been eroded in the larger river valleys on the eastern edge of the aquifer, there is a direct hydraulic connection between the major rivers and streams and the aquifer.

The existing OPL product pipeline runs north-south for approximately 8 km (5 miles) through the western portion of the designated sole-source aquifer area. For this proposal, the Thrasher Pump Station would be constructed near Maltby Road in the southwest corner of the designated aquifer area; the pipeline would run directly east from the pump station, across the southern portion of the aquifer, and exit the aquifer area at approximately MP 8.

Approximately 83 percent (10.5 km or 6.5 miles) of the pipeline corridor that would cross the aquifer would be underlain by till soils with dense till below 1.8 m (6 feet); 13 percent (1.6 km or 1 mile) would be underlain by poorly drained soils located in depressions and in low-lying areas adjacent to streams and rivers; and 4 percent (0.5 km or 0.3 mile) would cross well drained permeable soils that are directly underlain by portions of the aquifer (SCS 1983). These soils are mapped by the Natural Resources Conservation Service (NRCS) as Everett soils, and they occur within the first several miles of the pipeline corridor in the Bear Creek drainage.

Appendix B of the Support Document for the EPA Designation of the Cross Valley Aquifer as a Sole-Source Aquifer (EPA 1987) determined that the Cross Valley Water Association had over 2,600 service connections serving an estimated population of 8,000 people. There were approximately 3,300 people obtaining water from individual wells, springs, and small community well supplies. Total groundwater use within the sole-source aquifer was estimated to be 1.7 million cubic meters (60.5 million cubic feet) in 1986. In 1987, the Cross Valley Aquifer provided almost 78 percent of the drinking water used in the aquifer area. The EPA found that the water quality from the shallow aquifer zone was of good quality, but the deeper wells were high in hydrogen sulfide gas and iron.

Puget Sound Lowlands Province. The primary aquifers in this province are located in glacial drift on the margins of the Snoqualmie Valley, alluvium along the Snoqualmie River floodplain, and bedrock in the Cascade Mountains. Groundwater west of the Snoqualmie River is found in the Interlake Drift Plain between Lake Washington and Lake Sammamish, and the Eastern Drift Plain located west of the Snoqualmie River in the Snohomish River Valley. In the drift plains, primary aquifers are within stratified Vashon-aged glacial deposits or the underlying pre-Vashon glacial deposits. These aquifers are widespread and are extensively developed as groundwater

supplies for municipal, domestic, irrigation, and industrial uses. Alluvium is the primary aquifer in the larger stream valleys. Along the eastern margins of the plain, groundwater is obtained primarily from alluvial deposits and bedrock. These aquifers generally have lower yields than the drift plain aquifers to the west.

Groundwater development is extensive in the eastern and southern portions of the region. Most wells, especially those of higher yield used for public supplies, tap aquifers located in one or both of the drift plain deposits, although shallow dug wells utilize the limited perched groundwater in sand lenses within the overlying glacial till. The main aquifer in the Snoqualmie River Valley is located in the unconsolidated alluvial deposits associated with the river and the floodplain. Water quality in the alluvial aquifers generally is poorer, often high in iron compared to the water quality of the glacial aquifers.

Western Cascade Mountains Province. Along the pipeline corridor, aquifers in this region occur in the bedrock and in alluvial valleys of the larger tributaries to the Snoqualmie River. Groundwater flow in bedrock is primarily controlled by joints, bedding, and fractures. The groundwater table in these aquifers generally mimics topography and may be shallow or deep. Recharge occurs where weathered bedrock is exposed at outcrops, generally at higher elevations, and from percolation through overlying deposits and forest soils on slopes and lower elevations. Discharge from the aquifer occurs to streams and rivers at lower elevations.

Alluvial aquifers occur in the valleys of the larger streams. Generally, these are present where stream channel gradients are below 2 percent. These aquifers are limited in extent, restricted to the valley width, and are typically shallow in the Cascade Mountains. The aquifers are recharged from precipitation, from underlying bedrock aquifers, and from floodwaters in the associated stream. The aquifers provide baseflow to the associated stream or river.

Groundwater use in the Cascade Mountains east of North Bend is limited primarily to small individual domestic supplies and several small public supplies for campgrounds and ski resorts. The source of these groundwater supplies is typically bedrock, although groundwater in alluvial aquifers is used in the larger stream valleys.

Eastern Cascade Mountains Province. In the Eastern Cascade Mountains Province along the pipeline corridor, bedrock and small alluvial aquifers occur in the mountainous area, similar to the Western Cascade Mountains Province. In the foothills of the mountains, west of the Columbia River, basalt aquifers, terrace deposit aquifers, and larger alluvial aquifers are present. The primary aquifers in this region include alluvium within the Yakima River floodplain, sedimentary deposits in the Kittitas Valley area, and basalt in the high elevations on the east slopes of the Cascade Mountains.

Groundwater is extensively developed in the valleys of the Yakima River and its tributaries from alluvial and glacial deposits that are as much as 152 m (500 feet) thick. These deposits are hydraulically connected to the Yakima River and its tributaries, and are recharged by precipitation, as well as infiltration from streamflow and irrigation return flows. Recharge to the alluvial aquifer is from direct precipitation, from groundwater stored in surrounding terraces, and from floodwaters of the Yakima River and tributaries. The aquifer discharges primarily to the Yakima River. Surface

water rights in the Yakima Valley are being adjudicated. The interconnected nature of the river with the alluvial aquifer in its valley renders these rights and groundwater rights inseparable in some cases.

Groundwater obtained from upland sedimentary rocks near the Yakima and Columbia River Valleys can be of low to moderate yields and is used for domestic uses, stock watering, and irrigation. Recharge is from direct precipitation and lateral flow from the Cascade Mountain uplands. Groundwater discharge is to deeper rock units and to the alluvial aquifers of the Yakima and Columbia River Valleys.

Volcanic rocks in the Cascade Mountains yield little or no water, whereas the Columbia River Basalt that is exposed along much of the eastern part of the province is a substantial water-bearing unit. The thick series of basalt flows has a wide range of both permeability and yield. Studies show that structural warping of the rocks has caused subsurface damming of the groundwater, which results in several essentially separate groundwater basins.

Columbia Plateau Province. Groundwater is generally available in large quantities in the Columbia Plateau Province from the basalt bedrock. Multiple basalt aquifers provide complexity to the groundwater situation and are generally known as the Columbia River Basalt Group. The basalt thickness varies near the older underlying rocks, but increases to the southeast and is more than 3,050 m (10,000 feet) thick near Pasco. The basalt surface is thinly mantled by loess, but in areas to the north, east, and southeast, much of the plateau was scoured by enormous floods of glacial meltwater, exposing wide belts of basalt within the channeled scabland.

The basalt is recharged mainly by precipitation. Aquifer recharge is through direct infiltration and by seepage from intermittent streams. Thin rocky scabland soils probably are more conducive to recharge than are the fine loess soils elsewhere. In the western part of the plateau and under much of the pipeline corridor, a substantial amount of recharge is derived from leakage of irrigation canals, artificial reservoirs, and irrigated land under the Columbia Irrigation Project. Seepage to the aquifers from the imported water has created increases in the water table of as much as 61 m (200 feet).

Groundwater movement in the province is generally to the southwest. Groundwater flow rates within the highly permeable interflow zones between individual basalt flows can be rapid in response to withdrawal, although they are generally slow under prevailing natural conditions due to low hydraulic gradients. Loess overlies the basalt and generally does not yield appreciable quantities of water to wells. Wells that tap coarse glacial outburst deposits can store and transmit large quantities of groundwater. The quality of the groundwater is generally good, ranging from soft to hard, although the water has high concentrations of dissolved iron in some locations.

Groundwater from the basalts is used extensively for irrigation, particularly in the Pasco area. In some areas, water levels are declining due to pumping, and well boreholes have interconnected the various layered basalt aquifers. These boreholes allow groundwater in upper layers to flow into deeper layers, commingling waters of different quality and providing a potential conduit for contaminant migration.

3.6.2 Environmental Consequences

3.6.2.1 Proposed Petroleum Product Pipeline

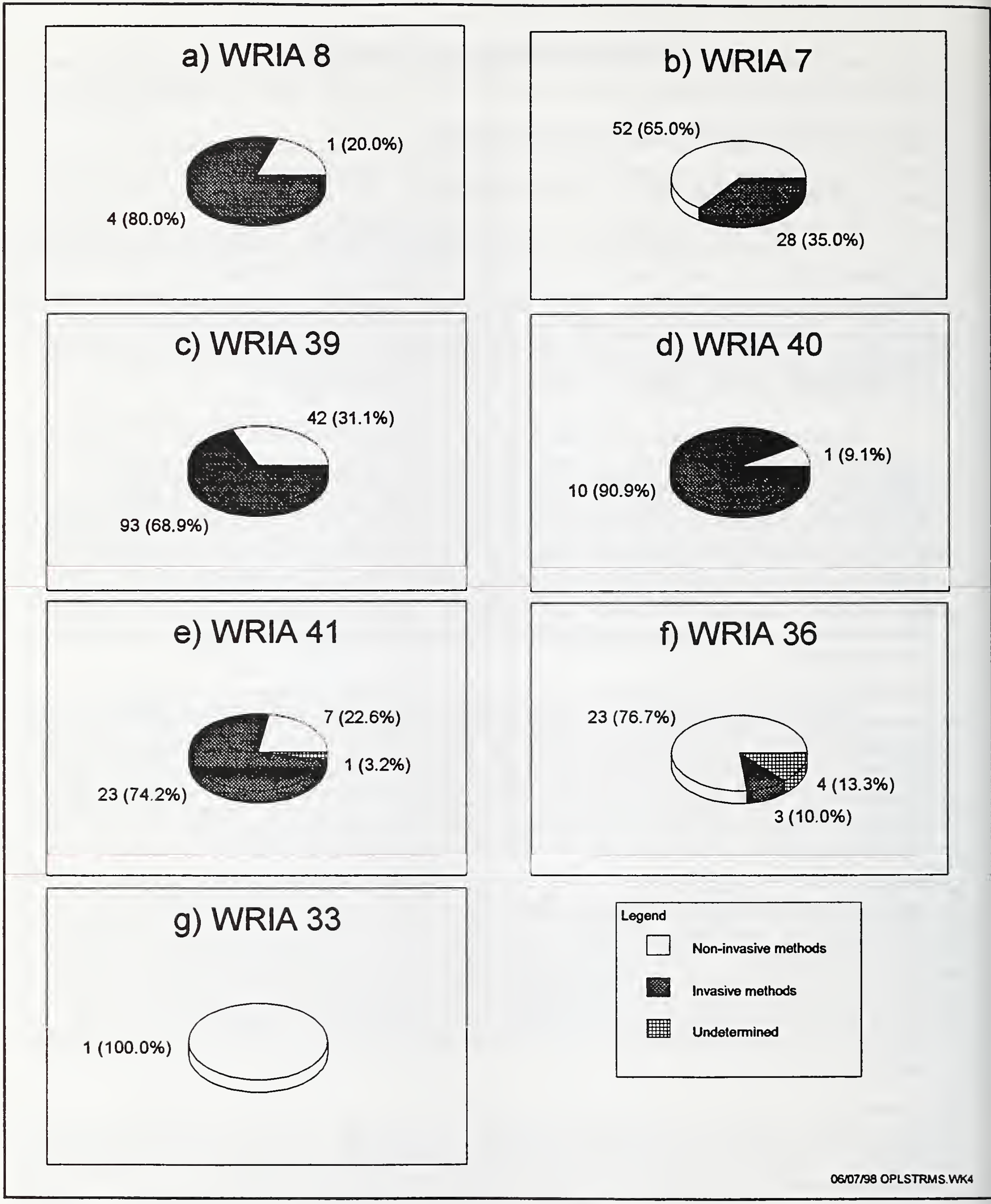
Construction Impacts - Surface Waters

Physical Disturbance of the Beds and Banks of Stream Channels. Bed and bank disturbance could result in short-term moderate impacts (lasting less than 3 years) in 60 percent of the channels that would be crossed, even with the design measures and BMPs proposed by OPL. Where multiple crossings of one channel or crossings of multiple channels within one watershed occur, the volume and duration of fine sediment on the streambed may increase relative to channels with single crossings, but impacts would remain moderate.

Stream crossing methods proposed by OPL are described in the ASC and are identified for each proposed channel crossing in Appendix D. Bridge, bore, horizontal directional drill, over-culvert, and under-culvert methods, in order of generally increasing potential water quality impacts, are considered "non-invasive" construction methods. By their design, these methods require little or no physical disturbance to the bed and banks of a channel, and thus would result in negligible impacts to bed and bank stability and resulting water quality. Any of the methods requiring physical trenching and disturbance to the streambed and streambanks are considered "invasive" construction methods. These include, in increasing order of impact intensity, dry trench, flume and trench, divert and trench, and wet trench.

Trench construction involves excavation of the streambed and banks using a trackhoe situated on an adjacent bank. On channels wider than the reach of the trackhoe, the trackhoe or a trenching machine would operate from portable bridges or mats. The pipeline crossing would be as nearly perpendicular to the stream as possible. Disturbances of the streambed, streambank, and bank vegetation would be limited to the amount necessary to construct the pipeline (9 m [30 feet]). Streambed spoils would be temporarily stored in contained holding areas outside the riparian area on one or both sides of the channel. The location of larger boulders would be noted and these specifically set aside to be returned to the same or similar positions. Similarly, large woody debris (LWD) that is encountered at a crossing would be handled in a way that causes the least bed and bank disturbance possible -- left in place, removed whole, or cut and partially removed. All LWD at crossings would be stored, then returned and stabilized in the channel during restoration of the bed and banks. Stream beds and banks would be restored including contouring to pre-construction elevations and revegetating banks. More aggressive stabilization measures may be required at some crossings.

Using a number of state and federal data sources (e.g., WARIS by WDFW, Data96 by WDNR, and USFS GIS), the ASC identified that the pipeline would cross 293 channels on the preferred alignment. Of the 293 crossings, 127 utilize non-invasive methods, 161 utilize invasive methods, and at 5 crossings the method (invasive or non-invasive) of crossing is uncertain. Figure 3.6-3 indicates the distribution of crossing types by WRIA.



NUMBER OF CHANNEL CROSSINGS BY METHOD IN EACH WRIA

Cross Cascade Pipeline
Washington
FIGURE 3.6-3

Despite efforts by OPL to identify all stream channels the pipeline corridor may cross, some Type 4 and Type 5 stream channels were probably missed. These smaller streams will be identified when the final centerline is established. Most unmapped channels are expected to be small, and intermittent or ephemeral in nature. Most would also be suitable for typical dry trench or flume and trench methods. With the implementation of construction BMPs (Appendix C), additional impacts at unmapped channels would be expected to be minor.

The pipeline corridor would cross some channels more than once, or have crossings of multiple tributaries upslope of the mainstem channel. These situations would occur in the following areas:

- Little Bear Creek (1) (WRIA 8), which is crossed in proximity at the mainstem and four moderate-gradient tributaries (2, 3, 4, and 5) ranging from 1 to 3 m (3 to 10 feet) in width. All four streams would be crossed using invasive methods.

- South Fork Snoqualmie River (WRIA 7) would be crossed twice by attaching the pipeline to bridges across the river (42 and 43). The pipeline corridor would parallel the South Fork on its left bank within the 100-year or 500-year floodplain (generally between 150 to 600 m [500 to 2,000 feet] from the river) for a distance of approximately 24 km (15 miles). OPL proposes to cross 44 tributary streams to the South Fork Snoqualmie River. Ten of these tributaries would be crossed using invasive methods including three wet trenched crossings (Hall, Mine, and Humpback Creeks).

- Numerous channel crossings would occur within the Yakima River Watershed (WRIA 39). The pipeline corridor would parallel the western shoreline of Keechelus Lake on the John Wayne Trail for a distance of approximately 9.5 km (6 miles). Within that section, OPL proposes to cross 15 tributaries to the lake, two of which would be crossed using invasive methods (Roaring [97], and Meadow [99] Creeks). The mainstem Yakima River would be crossed only once (147); however, a number of its tributaries would be crossed multiple times. Within the basin, Dry Creek would be crossed four times using invasive methods (156, 157, 160, and 161). Similarly, Jones Creek would be crossed three times (168, 169, and 170), Currier Creek two times (177 and 180), Naneum Creek two times (190 and 193), and Parke Creek four times (201, 205, 206, and 1-E) using invasive methods.

- The lower Crab Creek mainstem (WRIA 41) would be crossed three times (HD26-C, HD26-D, and HD26-E) using invasive methods. Five unnamed tributaries to the mainstem would also be crossed using invasive methods (230, 231, 238, 239, and 240).

Many of the situations include dry trench crossings of Type 4 or Type 5 streams. However, the potential cumulative impact to the channel conditions and water quality downstream of these multiple crossings would be increased relative to single channel crossings.

OPL notes that use of explosives could be required to obtain adequate burial depths in streams with a high percentage of bedrock and large boulders in their beds. The need to use explosives would be determined during the final design phase of the project. If blasting is required, shock waves could

weaken residual bed material and unconsolidated bank material, increasing their susceptibility to scouring and debris flow processes when saturated or at high flows.

It is possible that streambeds could experience preferential scouring and sorting of the backfilled trench during the next bankfull or larger event. If an extremely large event were to occur, scouring may be accelerated and the maximum scour depth attained. Surface water bodies most vulnerable to this type of impact include steep, confined channels with banks and beds composed of easily erodible unconsolidated sediments. Sediments can be entrained and subsequently deposited in sensitive downstream reaches. Silts and clays can remain in suspension and result in turbid conditions in downstream water bodies.

Removal of Riparian Vegetation. The proposal would result in minor impacts from riparian vegetation removal. Riparian and streamside vegetation would be removed at proposed crossings to create a total corridor width of 9 m (30 feet). The impacts of removing this vegetation could create potentially minor impacts on bank stability, shade and stream temperatures, LWD, and erosion just upslope of streambanks.

OPL alignment revisions and crossing method selection have minimized many of the potential impacts associated with riparian vegetation removal. Trees would be removed at 22 of the crossings. Grasses and other ground flora dominate the riparian area at 32 of the crossings. At the remaining crossings, construction would involve minor or no riparian vegetation disturbance because the crossing method is non-invasive or the crossing location lacks natural riparian vegetation.

The small amount of vegetation disturbance required at the stream crossings would reduce the impacts. However, bank stability could decline at crossings where vegetation would be removed at localized reaches 9 m (30 feet) long. Revegetation BMPs, including replanting native shrubs, use of an approved seed mixture for erosion control and monitoring, and a contingency plan, would mitigate much of the risk. However, some bank instability may persist (also see Section 3.4, Botanical Resources). The corridor would be allowed to revegetate with the exception of a maintained 3 m (10-foot) wide access trail.

Temperature impacts could include minor, very localized, and short-term temperature increases where shrubs and trees are cleared as part of crossing construction. Woody debris recruitment would be reduced by tree removal at about 22 crossings. The actual effect of this is unknown, but would be expected to be minor because in all cases the wood removed would be very small relative to the remaining volume along those streams. OPL would remove and store any LWD found in each stream crossing corridor, and replace it as part of crossing construction. Replacement of LWD would occur as close to the original configuration as possible.

Erosion and Sedimentation. Construction would generate minor to potentially major sediment-related water quality impacts despite its temporary effect. EFSEC may authorize a short-term variance for water quality as long as mitigation and application of all known, available, and reasonable methods of prevention are implemented. Federal agencies may include mitigation requirements as part of their approval process for the project.

During the construction phase, the primary impact would be increased erosion and sedimentation effects on water quality and channel conditions. The largest source of sediment would be the sand, silt, and clay released from the streambed and entrained in streamflow during construction of crossings using the invasive methods described above. Non-invasive methods substantially reduce the risk of impacts to water quality by avoiding in-channel excavation.

The magnitude of the actual impact at any crossing would vary widely based on the amount of fine material in the streambed, channel gradient, number and type of channel obstructions, crossing method, season, depth and velocity of streamflow, the effectiveness of BMPs, and the beneficial uses of the channel. Subsequent impacts may include deposition of transported sediments downstream. Silts and clays could remain in suspension and result in turbid conditions downstream.

BMPs to be used with these proposed crossing methods (see Appendix C) are usually not completely effective at preventing erosion and prohibiting offsite sediment transport. They are, however, effective in minimizing impacts by reducing the volume of sediment generated, restricting the distance that it moves downstream, and decreasing the rate at which it moves there. Nevertheless, impacts would occur where invasive methods would be used. Turbidity of the stream would likely exceed water quality standards during construction of crossings, particularly when water is released from flumes or diversions and generates a pulse of turbidity lasting for a relatively short period of time. Highly turbid water may negatively affect fish, fish habitat, and domestic and irrigation water supplies and equipment. These effects, however, would generally be temporary (lasting hours) and localized, and would diminish downstream. Similar effects occur in streams in disturbed watersheds whenever there are storm events.

Accidental Spill from Directional Drilling. The potential for a loss of drilling muds to the Columbia River from the proposed drilled crossing of the river (crossing 223) is relatively high due to subsurface geological conditions (see Section 3.2, Geology, Soils, and Seismicity). Potential secondary impacts could range from major to minor depending on the point of release to the streambed, the volume released, and the flow conditions at the time of release. Assuming a drilled crossing is feasible, a number of measures proposed by OPL and additional mitigation suggested in Section 3.2 would minimize the potential for this impact.

Accidental Spill of Hazardous Materials Associated with Construction Equipment. Small accidental spills of construction-related materials would generally result in negligible to minor impacts because of (1) the small volume of such spills, (2) the length of the corridor where such spills might occur, and (3) the use of BMPs. However, if releases occur immediately upslope of lower gradient channels with high-value fish or fish habitat, major impacts would be possible. Accidental leaks and spills resulting from equipment operation and fuel storage along the pipeline corridor may affect water quality where instream or near-stream construction occurs, or where slopes drain to watercourses.

OPL would implement a number of BMPs to avoid and minimize the volume of petroleum products introduced to the environment (see Appendix C). These can be enforced through the EFSEC Site Certification or the BLM Plan of Development Approval. Most releases would probably be small volumes with temporary, localized effects on water quality. Major impacts could be possible where larger or multiple releases occur in a localized area.

Discharge of Hydrostatic Test Water. Discharge of hydrostatic test water to streams would result in a minor impact to water quality. The pipeline at each water crossing would be hydrostatically tested at least twice. The pipe would be constructed, tested, placed in the trench, backfilled, and then tested again. Many crossings would again be tested as part of the testing of 10 longer pipeline segments once they are completed. The tests confirm the integrity of the materials and pipeline, and therefore minimize the potential for operational leaks and spills of petroleum products.

Water for tests at individual crossings would be obtained from the stream itself, or from water transported to the site. The relatively small volume of water used to test the pipeline individual crossings would be discharged to a filtration area (using straw bales or filter fence) and allowed to drain back to the stream channel without additional testing or treatment. The test water would be discharged to the stream at a rate that does not dominate the streamflow. Hydrostatic testing of individual stream crossing sections would be expected to result in negligible to minor impacts because of the small volumes of water used.

Exhaust water from testing larger sections of the pipeline would be discharged to the ground at the Stampede Pump Station (infiltration and evaporation), to the ground at the Kittitas Terminal or to the Cascade Irrigation Canal near the terminal, and to the Snake River indirectly (through filtration) near the pipeline terminus at Pasco. The discharge of the exhaust water can have water quality impacts on receiving waters. The test water should not introduce toxic materials to receiving waters, nor should it alter the physical and chemical characteristics of the receiving stream.

To minimize water quality impacts, a hydrostatic test water grab sample would be obtained prior to discharge from the pipe and analyzed for total suspended solids (TSS), oil and grease, and pH. If a pH adjustment is anticipated, the water would be treated as it is loaded into the test segment. If filtering is needed to reduce TSS or oil and grease to acceptable levels, it would be done as the water is discharged, through the use of a mechanical filter designed to collect solids or oil and grease. Water would discharge to the Snake River using straw bales or filter fence for erosion control. It could also be discharged to the Kittitas stormflow containment system (or to bare soil) for evaporation or infiltration. Discharge to the channels would be regulated to ensure that it does not dominate the flow of the receiving water body, even during low-flow conditions.

The storage tanks at the Kittitas Terminal would be similarly hydrostatically tested. Water supplies would be obtained from the Cascade Canal District. Discharge water would be drained into the ground onsite or to the stormflow containment system at the facility.

Impacts from test water releases would be short term and confined to relatively short reaches. No chemical additives would be added to the test water, with the possible exception of a buffer to moderate pH. Lab tests would characterize the water quality during final testing prior to discharge.

Impacts to Senior Water Rights from Water Quality Degradation. If construction resulted in water quality degradation in the Yakima River, potential impacts on the City of Cle Elum and the Kittitas County PUD could result by temporarily decreasing water availability or by increasing treatment costs to remove sediments. Increased turbidity and sediment load could impact senior surface water rights downstream, if the introduced sediment impairs the use at the time

the water is needed. The Kittitas County PUD obtains water from the Yakima River for domestic and industrial use with intakes downstream of 18 crossings where invasive methods would be used. Sediment-laden water could damage pumps and supply lines, delay use, and/or increase treatment costs. Potential impacts to municipal water rights are considered major, though actual impacts may be avoided through cooperative planning between OPL and the local governments.

OPL plans to trench several unlined irrigation canals in the lower Crab Creek drainage which could impact senior water rights in that area for the same reasons cited above. The proposal would involve boring under lined irrigation canals crossed by the pipeline corridor, thus avoiding similar water quality and water rights concerns.

Construction Impacts - Groundwater. Groundwater in the vicinity of the pipeline corridor is a major source of water for domestic and public supplies; groundwater also provides baseflow to streams and rivers. Potential impacts during construction, other than the effects of localized dewatering and small fuel spills from fuel storage and equipment operation, are considered low due to the short duration of construction relative to the movement of groundwater.

The sensitivity of groundwater quality and quantity to potential impacts during construction depends on the hydrogeologic regime the pipeline corridor would cross. Potential impacts to groundwater during construction are discussed below.

Erosion. Erosion and uncontrolled discharge could increase groundwater turbidity. However, OPL plans to use erosion control measures in all areas where soils are exposed during construction to minimize transport of sediment to water (see Appendix C for discussion of BMPs).

Spill of Hazardous Material Associated with Construction Equipment. As discussed earlier for surface water, impacts to groundwater from construction can occur as a result of small spills associated with refueling and maintenance of construction equipment. Minor spills would be contained and cleaned up by construction crews as part of their operating guidelines.

Excavation. Excavation of previously contaminated soils during construction and trenching could mobilize contaminants into a previously uncontaminated groundwater body. During trenching, there is the possibility of encountering historically contaminated soil as well as buried structures such as wells and underground storage tanks. Abandoned or "orphaned" wells could provide a direct pathway for contaminants to flow to an underlying aquifer. In these circumstances, proper disposal procedures would be implemented based on the type and quantity of contaminants, and the pipe would be rerouted to avoid contaminated soils discovered during construction. State regulation requires reporting of both circumstances. In the case of contamination, compliance with WAC 173-340 (The Model Toxics Control Act) is required. Chapter 173-160 WAC, Minimum Standards for Construction and Maintenance of Wells, includes procedures for proper well abandonment and would be followed upon encountering orphan wells.

Dewatering. Shallow groundwater may be encountered during trenching along stretches of the pipeline corridor. Laterally extensive shallow aquifers with seasonal groundwater levels within trenching depths are likely to be found in alluvial sediments and near major drainages. Perched or shallow groundwater zones may be encountered at various places along the pipeline

corridor including the plateau areas of Puget Sound, the Upper Yakima Basin, Kittitas Valley, and lower Crab Creek areas, and other areas associated with lakes, ponds, wetlands, and small drainages. In these areas, localized dewatering may be necessary. In areas where groundwater conditions could necessitate dewatering in large volumes, rerouting of the pipeline would be considered. In areas where dewatering would be necessary, it would be performed only for the period required to place and backfill the pipeline.

Where shallow groundwater is encountered in coarse sediments, the dewatering operation would likely require pumping and discharge of relatively large volumes of water. The dewatering process would depress the water table in the immediate vicinity of the excavation, causing a temporary alteration in the local groundwater surface. This could affect the ability of nearby wells to collect groundwater. After the excavation is backfilled, water levels would recover.

Interruption of Groundwater Flow Paths. Trench backfill, in most cases, would consist of excavated native soils. In areas where the native soils are consolidated, such as compacted till, the more loosely compacted backfill could result in a preferential groundwater pathway along the pipeline trench.

In areas where low-permeability soils occur at or near the surface, the trenching may cut through low-permeability soils and intercept higher permeability materials underneath. This could allow water to drain more quickly into underlying soils, allowing for preferential infiltration. In these areas, identified as part of the advance geotechnical evaluation along the pipeline corridor, the backfill would be compacted to match the native overlying soils, and if necessary, the bottom of the trench would be lined with a low-permeability material.

Although these impacts might be minor with regard to the groundwater resource, they could be more substantial for a receiving stream or other surface water body such as a wetland or lake.

Construction Impacts - Columbia River Approach Options. Impacts to water quality resulting from construction of either of the YTC corridor segment options would be similar to those resulting from construction of the proposed route, and would be negligible to minor. Streams crossed by these segment options are intermittent and construction would be performed only when they are dry.

Construction Impacts - Columbia River Crossing Options. In addition to the proposed Columbia River crossing method (horizontally drill a crossing downstream of Wanapum Dam), OPL has identified four alternative Columbia River crossing routes: dredging a crossing north of I-90, attaching the pipeline to the I-90 Bridge, placing the pipeline on Wanapum Dam, or attaching the pipeline to the Burlington Northern Beverly Railroad Bridge. There are also various approach routes to the alternative crossing sites.

The alternate routes for the dredged and I-90 Bridge crossings continue east on the north side of I-90, cross the river, and continue south along the east side of the Columbia River, rejoining the proposed pipeline corridor approximately 25 km (4 miles) east of Wanapum Dam. With the exception of the Columbia River and Ryegrass Coulee, streams crossed by these two alternative

routes (crossings 24a to 24c) are intermittent and would be crossed when they are dry. Ryegrass Coulee would be a bored crossing.

There would be negligible impacts to water quality if the pipeline crossed the Columbia River via the I-90 Bridge, the railroad bridge, or Wanapum Dam. Impacts to water quality from crossing the Columbia River via a dredged crossing would be greater than the proposed drilling crossing, and could be moderate to major. Dredging the Columbia River would result in resuspension of sediments, temporarily increasing turbidity and possibly pollutant concentrations.

There are also several alternative approach routes which originate at the YTC segment option north of I-90 and extend to the proposed crossing location (crossing 223) and the Burlington Northern Railroad Bridge crossing. This includes 14 crossings in the Park Creek (208 - 215), Sagebrush Springs (216 - 217), Canyon Creek (218 - 219), and Johnson Creek (220 - 221) drainages which would be flumed or trenched when dry, resulting in minor impacts.

Operational Impacts - Surface Waters

Long-Term Channel Changes Expose Pipeline. If stream erosion or migration exposes the pipeline during the lifetime of the project, the risk of damage to the pipeline, and subsequent release of product to water, could result in a potentially major impact to water quality. The pipeline could be exposed to abrasion by sediment transport on the streambed. Steep, confined channel forms are expected to have the greatest susceptibility to exposure from vertical scouring, but alluvial fans and meandering channels could be subject to exposure by lateral migration.

If the pipeline were exposed by scouring at river and stream crossings, damage to the pipeline might occur. To anticipate and address this issue, OPL would locate the pipeline 0.6 m (2 feet) below the maximum scour depth identified for each channel for the full width of the floodplain that could be occupied by a laterally migrating stream channel. Burial at this depth would prevent exposure that might otherwise occur through channel degradation (downcutting). In addition, thicker gauge pipe would be used and the pipe would be coated with concrete or river weights used to reduce the potential buoyancy under the channel. In this fashion, the risk of pipeline exposure, damage, and subsequent loss of oil from damage would be much reduced.

The actual methodology to identify the maximum scour depth on a site-specific basis is currently under review. The final methodology used to determine maximum scour depth would be agreed on by all federal and state agencies involved.

Water Quality Degradation from a Leak or Spill. The greatest potential impact to water quality during pipeline operations would be associated with a leak or accidental release of product, which would have major detrimental impacts on water quality and subsequent beneficial uses. Refer to Section 3.18, Health and Safety, and Appendix A for assessment of pipeline spill risk.

Design and construction features and post-construction BMPs proposed by OPL are described in Appendix C. Key features that would ensure minimal impacts during operation include the following:

- OPL preparation of a Spill Response Plan before project implementation that addresses containment and cleanup issues.

- Inclusion of block valves at spacings sufficient to reduce the number of potential large oil releases, and placement of trench plugs in the pipeline trench upslope of each bank of a crossing (to prevent small leakages from entering a stream via the trench fill). A block valve damaged by a slide may not function.

- Long-term monitoring of:

  - erosion conditions to prevent potential pipeline exposure;
  - corrosion at crossings (and in areas of shallow groundwater) to prevent weakening of the pipeline; and
  - leaks and spills to provide adequate lead time for prevention and cleanup actions.

Conflicts with Senior Water Rights. A spill or leak of any size would have a major potential impact on permitted senior water rights. A spill could contaminate water supplies and/or damage equipment. Impacts to senior water rights could occur if a spill or leak of oil from the pipeline entered a stream or river and impaired the beneficial use of the resource. The Spill Response Plan, discussed earlier, would include coordination with state and local agencies, municipalities, and communities, to address compensation as well as spill containment and cleanup issues. The plan would be WRIA-specific, and would be of particular concern in WRIA 39, Upper Yakima River, due to ongoing adjudication in that watershed.

In the event of a spill, all downstream surface water (and groundwater) right holders would be notified of the spill and an assessment made as to the degree and quantity of impaired use. Water right holders would be compensated for loss or impairment of water uses for the duration of the impact.

Operational Impacts - Groundwater

Releases of Petroleum Product. The potential for substantial impacts to groundwater would occur primarily during operation of the pipeline if a release of petroleum product occurs. Existing and senior groundwater right holders may be impacted if a spill or leak were to occur, and the product reached the groundwater table and migrated to a downgradient well or spring. Pipeline releases can be associated with leaks, rupture due to seismic shakings, ground rupture from faulting or landsliding, human-caused events, or damage of the pipeline by corrosion.

A sensitivity and potential impact rating has been developed to assess which aquifers are the most critical and where additional protective measures and monitoring are needed to prevent and/or minimize impacts (Table 3.6-3). The rating system ranks the sensitivity of groundwater regimes to potential impacts from the proposal, primarily leaks or spills. The impact rating considers the value

Table 3.6-3. Groundwater Sensitivity and Potential Impact Rating Criteria

Index Parameters	Parameter Description and Justification	Sensitivity Rating Values	Relative Rating Value Description
Groundwater Regime*	The groundwater regime that the pipeline segment is located in is an indicator of the resource value (i.e., potential yield to wells and connection to surface water resources), and potential to transport contamination if a pipeline leak should occur.	1 = Groundwater Regimes III, IV and VI 2 = Groundwater Regimes II and V 3 = Groundwater Regimes I and VII 4 = Groundwater Regime VIII	The lowest sensitivity rating for regimes III, IV and VI reflects the low permeability, transport potential, and potential well yield that these groundwater zones exhibit. Groundwater regimes II and V exhibit potentially high well yields but may not be directly associated with surface water bodies, and are typically heterogeneous, limiting transport potential. Groundwater regimes I and VII exhibit the largest potential for contaminant transport, and impact to surface waters (via irrigation pumping from regime VII and direct baseflow from regime I). The greatest sensitivity is assigned to regime VIII, sole-source aquifer, due to the importance of protecting the aquifer.
Groundwater Use	The groundwater use index characterizes the current value of the resource to human users within the groundwater regime along the pipeline segment.	0 = unknown minor uses 1 = domestic, limited public, irrigation and industrial 2 = public The rating value is the sum of each of the use index values assigned to each segment.	Public supply use is given the largest sensitivity rating due to the potential impacts to a large number of users. Domestic, irrigation and industrial uses are assigned a lesser sensitivity rating value because they are not subject to a public distribution system and in the case of irrigation and industrial, are not a source of drinking water.
Depth to Groundwater	The depth to groundwater, or separation distance, is the vertical distance from the pipeline to the aquifer beneath the pipeline segment. The aquifer is considered to be the uppermost groundwater zone that can provide usable quantities of groundwater to wells and which supplies baseflow to streams. This parameter does not include near-surface soil water or extremely limited perched groundwater zones.	1 = >100 feet below surface 2 = 50 - 100 feet below surface 3 = 0 - 50 feet below surface	The sensitivity values for depth to groundwater are somewhat arbitrary, and are selected to represent the range of aquifer depths that occur along the alignment. Additionally, in sediments with permeabilities generally sufficient to yield water to a public supply well (100 gpm or greater), leaked product could migrate up to 50 feet within a 24-hour period, which is assumed to be a reasonable response time if a leak should occur.

Table 3.6-3 Continued

Index Parameters	Parameter Description and Justification	Sensitivity Rating Values	Relative Rating Value Description
Separation Sediments	The characteristics of the sediment that separate and occur between the proposed pipeline and the uppermost aquifer are critical to assessing the risk of potential contamination from the pipeline if a leak were to occur. Low-permeability sediments would minimize downward migration of leaked product, containing the spill within the immediate vicinity. Permeable sediments would allow for relatively quick percolation of leaked product to the uppermost aquifer.	1 = glacial till, loess, competent bedrock, clay or other confining material. 2 = low permeability or heterogeneous transmissible sediments including fine to medium sand and well graded sand, silt, and gravel. 3 = permeable poorly graded sediments including sand and gravel and highly fractured bedrock.	The lowest permeability capping materials are rated with the lowest sensitivity, and the highest permeability materials are rated with the highest sensitivity. The selected sediment categories represent the range of materials found along the alignment.

* See Table 3.6-2 for description of groundwater regimes.

of the aquifer resource, soil permeability, and the depth of the water table and water-bearing unit underneath the pipeline.

Table 3.6-4 provides the milepost segment for separate groundwater regimes (or aquifer types) found along the pipeline corridor, as defined in Table 3.6-2, along with a description of the groundwater uses in each segment, typical depth to groundwater, and the impact sensitivity rating for each segment. The impact sensitivity rating for each groundwater regime segment along the pipeline corridor is a relative indicator of the value and environmental sensitivity of that segment to a potential leak or spill from the pipeline.

The mean impact sensitivity rating for all the segments along the pipeline corridor is 7.8, with a standard deviation of 1.6. Ratings of 10 or greater can be considered significantly more sensitive than the mean or typical conditions found along the pipeline corridor. These more sensitive aquifer segments are those used for public supplies and/or are susceptible to relatively rapid spread of product if a spill were to occur. Such sensitive segments underlie 117 km (73 miles) or approximately 32 percent of the pipeline corridor. The majority of the sensitive segments occur in the Puget Sound Lowland region, west of the Snoqualmie Tunnel.

The potential for leaks and spills from the pipeline during operation is a function of the integrity of the pipe and associated facilities. All facilities and the pipeline would be tested hydraulically to ensure integrity prior to operation and introduction of product. A potential for leaks and spills exists at valves and pumping stations where mechanical failures could occur. These spill volumes are considered to be less than those that could occur from a leak or breach in the pipe; therefore, block valves would be used to contain large spills by isolating large segments of the pipeline.

Pipe rupture can occur from damage by corrosion, unauthorized excavation within the pipeline corridor, or by the effects of water forces at stream crossings if the pipeline becomes exposed or placed under differential buoyant forces, creating stresses in the pipe. Corrosion of the pipeline metal can occur, particularly where fluctuating shallow groundwater levels periodically inundate the pipe or where the pipe is submerged in corrosive waters. Corrosion would be monitored periodically along the entire pipeline corridor and more intensively in the areas of higher risk. Cathodic protection would be employed where needed in areas of high water table and at stream crossings and in floodplains.

Preventing corrosion and impacts from potential leaks and spills would be a function of initial design, but also a function of effective monitoring. Monitoring for pipeline integrity and corrosion, and monitoring the mechanical conditions of valves and pump stations on a regular basis, would ensure low probability of failure and leakage. Routine pipeline inspections and pressure sensing in the pipe would provide early detection of spills. Early spill detection would prevent a substantial leak and allow for rapid cleanup before significant spread of product. In addition to line monitoring, equipment used to inspect the pipe's interior (a "smart pig") would be used periodically to detect areas of pipeline weakness. In the most sensitive pipeline segments (Table 3.6-4), increased inspection and line monitoring would be employed relative to other less sensitive sections of the pipe.

Table 3.6-4. Groundwater Conditions along Proposed Pipeline Corridor

Pipeline Segment (milepost)	Groundwater Regime[a]	Known Groundwater Uses Downgradient of Alignment[b]	Estimated Water Table Depth Below Surface (feet)	Vulnerability/ Impact Rating (Scale of 4-12)[c]	Specific Recommendations/ Comments[d]	Federal Owner
0 - 8.15	II & VIII	PUB, IRR, DOM	~100	10	For Cross Valley Sole-Source Aquifer, coordinate spill response w/ Cross Valley Aquifer Association; ***place block valve east of Echo Lake wetland; provide special trench design to impede leakage from trench***	
8.15 - 9.3	I	DOM	~20	9	Low yield/poor water quality	
9.3 - 11.9	II	limited DOM	~100	7		
11.9 - 16	III	limited DOM	20-50	7		
16 - 33.7	II	PUB, DOM, IRR	10-50	10	Coordinate spill response w/ City of Carnation	
33.7 - 41.05	I	IND, PUB, IRR, DOM	10 - 15	11	Coordinate spill response w/ Cities of Snoqualmie and North Bend	
41.05 - 56.2	I & II	DOM, limited PUB	10 - 15	10	Tinkham & other state park campgrounds present	USFS
56.2 - 59	III	DOM, possible limited PUB	Variable, generally >100	5	Commercial and ski areas present @ MP 58	USFS
59 - 64	I & II	possible limited DOM	40	9		USFS
64 - 73.35	II	possible limited DOM	~90	7		USFS
73.35 - 75.8	III	DOM, limited PUB	Variable, generally >100	5	Town of Easton, Easton Lake State Park @ MP 74-75	USFS
75.8 - 77.8	I	unknown, possible limited DOM	~70	8		
77.8 - 98.9	II	DOM, IRR	100->300	6	Indian John rest area @ MP 93	
98.9 - 112.4	I	DOM, IRR	20-60	10		
112.4 - 114.9	VII	DOM, possible IRR	~100	9	Impact rating assumes basalt bedrock is permeable from the surface to water table	

Table 3.6-4. Continued

Pipeline Segment (milepost)	Groundwater Regime[a]	Known Groundwater Uses Downgradient of Alignment[b]	Estimated Water Table Depth Below Surface (feet)	Vulnerability/ Impact Rating (Scale of 4-12)[c]	Specific Recommendations/ Comments[d]	Federal Owner
114.9 - 126.4	VII	IRR, DOM, PUB	60-100	10	Overlain by 50+ feet alluvium, City of Ellensburg	
126.4 - 129.4	VII	Unknown, possible limited DOM	~100	8		
129.4 - 131.4	VII	Unknown, possible limited DOM	Variable, generally >100	7	Overlain by 50+ feet alluvium	
131.4 - 147.4	VII	Unknown, possible limited DOM	~100	8		
147.4 - 153.4	VII	DOM	300	8	Overlain by 50+ feet outburst flood deposits, may be shallow sources within deposits	
153.4 - 163.9	VII	DOM, IRR	400	8	Overlain by 50+ feet lacustrine deposits	
163.9 - 171.4	VII	IRR, IND, DOM	200	8		
171.4 - 177.4	VII	IRR, DOM	100	9	Overlain by ~50 feet outburst flood deposits, may be shallow sources within deposits	
177.4 - 181.9	VII	Unknown	200	6	Overlain by 50 feet of alluvial deposits (landslide)	
181.9 - 183.4	VII	IRR, DOM	400	6	Overlain by <50 feet loess	
183.4 - 187.9	VII	IRR, DOM	400	6	Overlain by ~50 feet lacustrine deposits	
187.9 - 190.9	VII	IRR, DOM	500	6	Overlain by >100 feet loess and lacustrine deposits	
190.9 - 191.9	VII	IRR	500	6	Overlain by ~50 feet lacustrine deposits	
191.9 - 193.9	VII	IRR	300	6	Overlain by >100 feet loess and lacustrine deposits	
193.9 - 199.4	VII	IRR, DOM	300	8	Overlain by ~100 feet outburst flood and lacustrine deposits	

Table 3.6-4. Continued

Pipeline Segment (milepost)	Groundwater Regime[a]	Known Groundwater Uses Downgradient of Alignment[b]	Estimated Water Table Depth Below Surface (feet)	Vulnerability/ Impact Rating (Scale of 4-12)[c]	Specific Recommendations/ Comments[d]	Federal Owner
199.4 - 202.9	VII	IND, IRR	100	9		
202.9 - 206.9	VII	IRR, DOM	200	8	Overlain by ~100 feet outburst flood and lacustrine deposits	
206.9 - 208.4	VII	IRR, DOM	300	7	Overlain by ~100 feet outburst flood deposits, may be shallow sources within deposits	
208.4 - 213.4	VII	IRR, DOM, IND	250	6	Overlain by ~100 feet lacustrine deposits	
213.4 - 219.9	VII	IRR, DOM	200	6	Overlain by >100 feet loess	
219.9 - 221.4	VII	IRR, DOM	100	9	Overlain by >100 feet outburst flood deposits, may be shallow sources within deposits	
221.4 - 228.9	VII	IRR, IND, DOM, PUB	100	9	Overlain by >100 feet loess, City of Pasco	
228.9 - 230.7	VII	IRR, IND, DOM	50	10	Overlain by <100 feet outburst flood deposits, may be shallow sources within deposits	

Note: Mileposts shown are approximate and subject to change.

[a] I - Alluvium
II - Glacial-Fluvial Deposits
III - Cascade Mountain Bedrock
IV - Loess/Dune Deposits
V - Outburst Flood Deposits
VI - Lacustrine Deposits
VII - Columbia River Basalts
VIII - Sole-Source Aquifer

[b] PUB - Public Supply
IRR - Irrigation
DOM - Domestic
IND - Industrial

[c] Rating is the sum of the Sensitivity Rating Values in Table 3.6-3. Ratings of 10 or greater are significantly more sensitive than the typical conditions along the pipeline corridor.

[d] Items in regular typeface are from OPL 1998, Application for Site Certification. Items in ***bold italic*** are additional mitigation suggested by the EIS team.

Interruption of Groundwater Flow Paths. The presence of the proposed facilities could impact groundwater movement and water levels at the Kittitas Terminal by reducing infiltration in areas where compacted soils or impermeable liners are placed and where stormwater collection systems are operated. However, due to the relatively small area covered by these facilities, these impacts would be minor.

Water Rights. As mentioned earlier, senior groundwater right holders might be impacted by operation if a spill or leak were to occur, and the product reached the groundwater table, migrating to a downgradient well or spring. As part of the proposal, OPL would develop a compensation plan worked out with the communities, state and local agencies on a WRIA basis. A separate agreement would also be established with the Cross Valley Aquifer Association to protect the Cross Valley Aquifer (see next subsection). There are no other sole-source aquifers or other groundwater areas that are being comprehensively managed (i.e., no wellhead protection programs) along the pipeline corridor.

Cross Valley Aquifer. There is one designated sole-source aquifer in the vicinity of the pipeline corridor. The Cross Valley Sole-Source Aquifer is located in south Snohomish County. The pipeline corridor would cross the aquifer from approximately MP 0 to MP 8. The existing Olympic pipeline has been in this location for 30 years, even before the designation of the aquifer as sole source. There are no restrictions limiting uses or construction practices over the aquifer.

The majority of historic releases from the existing pipeline system have been at the pump stations or block valves. OPL would construct one pump station (Thrasher) over the sole-source aquifer. The pump station would be electronically equipped to detect leaks and would be located on an upland area underlain by till. A valve would be placed to minimize spill volumes in case damage to the pipeline occurs.

Due to the importance of the aquifer as a sole source for drinking water, a specific monitoring plan with increased line monitoring, pigging, and groundwater monitoring would be developed in conjunction with the Cross Valley Aquifer Association to ensure adequate response time if a spill should occur.

The pipeline corridor across this sole-source aquifer is generally underlain by low permeability till in most places. In these areas, a leak or spill would generally be contained to within the upper 1.8 m (6 feet) of soil. As previously discussed, well-drained soils with hydraulic connection to the aquifer occur in limited sections along the pipeline corridor. In these areas, trench lining would be employed that would prevent oil from escaping the trench, and would direct the oil toward a lower sensitivity area for capture and cleanup. The exact locations and lining techniques would be developed in conjunction with the Cross Valley Aquifer Association.

Operational Impacts - Columbia River Approach Options. Under normal operating conditions, operation of the pipeline would not result in impacts to water quality. If a spill occurred, it could result in minor to major impacts to water quality depending on the location, timing, and volume of the spill. Impacts of a spill along YTC segment options would not be substantially different from a spill along the proposed pipeline corridor in terms of water quality.

Operational Impacts - Columbia River Crossing Options. Impacts to water quality from normal operation of the pipeline are not expected for any of the crossing options. If product were to spill into the Columbia River, minor to major impacts to water quality could occur, depending on the timing and the volume of the spill. Impacts would be similar to those described in the Columbia River spill scenario in the spill analysis section of the ASC.

Cumulative Impacts. Increased risk of negative cumulative effects to watersheds during construction could result within watersheds with harvested and roaded areas upstream; multiple pipeline crossings (discussed earlier in this section); disturbances by wildlife; heavy winter applications of sand and gravel to highways and roads; other near-stream ground disturbing activities; and others. Turbidity of the water column would result in temporary impacts, even on a cumulative basis. Deposition of sediment from multiple sources in low-gradient stream reaches could result in streambeds with fine sediment increasing faster than peak flows can remove and transport it. Cumulative effects could be more pronounced in basins that would contain numerous invasive crossings of streams (e.g., South Fork Snoqualmie River), where sediment from several tributaries would be transported to a mainstem system. High fine sediment concentrations in the streambed often have negative implications for aquatic ecology.

Quantifying the actual sediment release from each stream crossing and estimating the ultimate portion of that release which might reach the principal river in a watershed is beyond the scope and capability of this EIS. To be useful, the analysis would have to include all other existing and planned timber harvest activities, and such analysis is attempted in various timber harvest plans. It can be assumed that some sediment release may reach the mainstem from each pipeline crossing, and the less effective revegetation and sediment control measures are, the more sediment may reach the mainstem. While construction across rivers in logged watersheds may increase sedimentation in rivers already subject to greater flow fluctuations and sedimentation, vegetation removal for the project in such areas would be relatively minor. To minimize any potential cumulative impacts, sediment and erosion control must be aggressively managed, especially at crossings that are a short distance from the river into which they flow.

After construction, and after revegetation and other stabilization measures are in place, no cumulative impacts are anticipated. Hydrostatic test water intake and discharge is not significant and not a cumulative impact; it would occur over different watersheds at different times.

3.6.2.2 No Action

Surface Water. The No Action Alternative would result in no impacts associated with OPL's proposal. However, the risk of other oil spill-related impacts from trucks would not decrease but instead may increase (see spill analyses section of ASC). Potential impacts from barge activities and transfer operations on the Columbia River would continue.

Assuming a travel corridor using I-90, I-82, and other roadways, many of the trucks carrying product that is not carried by the existing north-south pipeline would cross many of the same stream channels as the proposed pipeline. For example, the South Fork Snoqualmie River would be crossed four times by a truck route (compare two times for the pipeline corridor) and is paralleled by I-90 for

a distance greater than the proposed pipeline corridor. The Yakima River is crossed five times by the interstate highways (compare one time for the pipeline corridor) and is paralleled for a much greater distance than the proposed pipeline. The Columbia River, like the pipeline corridor, is crossed at I-90. The risk of oil loss to the environment would increase through time with the increased risk of tanker truck accidents. The cleanup of oil spills on roads could be easier to contain (relative to a buried pipeline) if the spill could be contained on impervious surfaces; such a situation depends on the circumstances of the spill.

The ASC indicates that barge traffic in the Pacific Ocean along the Washington coast and on the Columbia River from the Pacific Ocean to Pasco probably would also increase without implementation of the proposal (OPL 1998). Columbia River traffic could increase over 50 percent in the next 23 years to over one trip per day. The corresponding risk of oil spills and potential impacts to the Columbia and Snake Rivers increases with increased barge use. However, the expanding use of double-hulled barges reduces the risk of barge-related oil spills. See Section 3.18, Health and Safety, for further discussion of spills associated with the proposal and the No Action Alternative.

Groundwater. Little or no impact to groundwater is expected from No Action. A truck spill onto soils overlying a shallow groundwater table would have impacts similar to a pipeline. However, cleanup may be easier as a result of response access, lower volumes, and the fact that trucks would be on highways and not directly over an aquifer. Spills leaving roadways and entering ditches could create some groundwater risk.

3.6.3 Additional Proposed Mitigation Measures

This section presents mitigation measures beyond those identified by OPL in the ASC that can further reduce the risk of impacts on water resources.

3.6.3.1 Construction Mitigation and Subsequent Impacts

Stream Channel Bed and Banks

- OPL has indicated that undersized culverts that are identified would be replaced (see Appendix C). To ensure all undersized culverts are identified, OPL should meet with all land owners and/or entities with easements or ROW where under- or over-culvert crossings are planned (e.g., USFS, State Parks, etc.), and identify culverts whose future maintenance or replacement may be restricted by the pipeline; survey culvert conditions and assess their capacity to pass flows from a 100-year storm event; and identify inadequate culverts needing replacement and record design criteria for replacement structures (all culverts on crossings in the Wenatchee National Forest may be undersized). Culvert replacement would improve fish passage and reduce erosion.

- Monitor culvert and channel conditions at all replaced culverts 1 and 3 years after construction for desired fish passage and erosion concerns. Take corrective actions as

necessary. Add any new structures to the long-term monitoring plan for all stream crossings. Replacement of culverts would require additional instream construction activities that could result in additional temporary impacts to water quality during the construction period, including increases in turbidity and sediment transport. However, these potential impacts would be less substantial than impacts resulting from a failure of an undersized or degraded culvert.

Streamside Vegetation

- Consider leaving some of the larger trees which are cut down in the riparian area. Where possible, these trees may be pushed over so that the root wad stays attached. This measure would enhance long-term LWD recruitment. LWD could also be used for crossing stabilization or fish enhancement, taking care that placement would not generate scour of backfill materials in the streambed that are not fully stabilized.

- Consult wildland hydrologists or fisheries habitat managers prior to replacement of LWD removed from the stream or riparian area during construction. LWD should be partially buried and anchored. This mitigation would ensure LWD stability during high streamflows and maximize the benefits for fish habitat.

Floodplains

- To ensure adequate burial depth of the pipeline for crossings identified as highly vulnerable to water quality and fisheries impacts, including those with FEMA-identified 100-year floodplains, utilize water surface profile model(s) as well as FEMA flood-elevations and field indicators to identify the 100-year flood boundary.

- On all crossings, consult a hydrologist or geomorphologist to assist in identification of floodplain boundaries in the field.

- Bury the pipeline 0.6 m (2 feet) below maximum scour depth throughout the entire floodplain.

These mitigations would further reduce the potential for exposure of the pipeline.

Water Quality. It is not possible to totally eliminate all water quality impacts, such as erosion/sedimentation, and it will always be possible for a pipeline leak to occur. However, to reduce potential impacts as much as possible, the following additional measures are recommended:

- OPL has indicated they would provide long-term monitoring to detect erosion and prevent potential pipeline exposure (see Appendix C). The most sensitive stream crossings should be monitored more frequently and more intensively.

- During the design phase of the project, develop detailed stream crossing plans and specifications for the sensitive stream crossings (high resource value or difficult site conditions), including site-specific scour depth and width estimates, site-specific sediment

and drainage control plans, site-specific streambank and bed restoration plans, site-specific stabilization plans, site-specific stream crossing construction plans with phasing and sequencing, and site-specific monitoring plans. Adapt these plans in the field for application to all of the crossings.

- Consider the use of a polymer in place of bentonite for drilling. Select a polymer that begins to break down naturally after a few days in the environment, similar to polymers used in drilling water wells.

- To protect water quality in the Columbia River, ensure that design and construction of horizontally drilled crossing of the Columbia River minimize the potential for discharge of drilling muds to the river. (See specific discussion of additional mitigation measures in the "Construction Mitigation and Subsequent Impacts" subsection in Section 3.2, Geology, Soils and Seismicity of this EIS).

- Monitor water quality downstream of trenched or drilled crossings, including the presence of sheens and scums, during equipment operation in and near channels known or suspected to contain salmonids. If a problem is detected, discontinue construction until it is rectified.

- Trench plugs should be installed at changes in pipeline slope in areas of shallow groundwater tables.

Water Rights

- Coordinate timing of invasive crossing construction upslope of Cle Elum and Kittitas PUD water intakes with these entities. Construct crossings under low-flow conditions to minimize sediment transported in the Yakima River wash load.

- Provide additional measures to protect against sediment at water intakes, including measures to filter sediment suspended in the water column.

3.6.3.2 Operational Mitigation and Subsequent Impacts

- At each crossing site, and especially those using invasive crossing methods, survey both of the elevations of the installed pipeline and the reconstructed streambed and banks. Install and survey a benchmark and a second reference point near each crossing. Then monitor cross-sectional morphology at each crossing at 1, 3, and 5 years after construction by repeated level surveys. Repeat monitoring after every storm event that substantially exceeds the peak storm observed in each WRIA during the first 5-year interval. Whenever the depth of the pipeline is halved relative to the original burial depth, notify appropriate agencies and assess whether stabilization measures are appropriate. If the bed elevation ever reaches the original maximum scour depth of the channel, OPL should meet with the appropriate agencies and identify and modify stabilization and spill prevention measures, including pipeline closure, if necessary. These

measures would greatly reduce but not eliminate the potential for exposure and subsequent breakage of the pipeline.

3.7 FISHERIES

3.7.1 Affected Environment

The pipeline corridor would cross through several major watersheds between Woodinville and Pasco. These include (from west to east) the Sammamish, Snohomish, Snoqualmie, South Fork Snoqualmie, Yakima, and Columbia River Basins. The pipeline corridor ends at an existing terminal on the north shore of the Snake River.

OPL has identified 293 rivers, streams, and irrigation canals that the pipeline corridor would cross (see the EIS Map Supplement). Numerous small, intermittent or ephemeral channels with a defined bed and bank would also be crossed, many of which have not yet been cataloged because of their small size. The water courses crossed by the pipeline corridor support habitat for a number of fish species including salmon, steelhead, trout, warmwater gamefish, and non-game fish (Table 3.7-1). Crossings supporting fish and species present are listed in Appendix D. Some streams that the pipeline would cross do not support fish or provide only low-quality fish habitat, but they contribute to the water quality of fish-bearing waters downstream.

3.7.1.1 Threatened and Endangered Species

Several fish populations present in the area of the proposal are either listed as threatened or endangered, are proposed for federal listing, or are candidate species for federal listing under the Endangered Species Act (ESA). These listings and proposals are shown in Table 3.7-1.

On March 9, 1998, the National Marine Fisheries Service published a proposed rule to list the Puget Sound chinook salmon evolutionarily significant unit (ESU) as threatened, and to propose designation of critical habitat for this ESU (63 FR 11481). The Puget Sound chinook salmon ESU consists of all naturally spawned spring, summer, and fall runs of chinook salmon in the Puget Sound region from the North Fork Nooksack River to the Elwha River (inclusive). Within the project area, the Snohomish River mainstem, the Tolt River, and Cherry and Harris Creeks support Puget Sound chinook salmon.

On June 10, 1998, the USFWS listed the Columbia River population segment of bull trout as threatened (63 FR 31647) and proposed to list the Coastal Puget Sound population segment of bull trout as threatened (63 FR 31693). The Columbia River bull trout population segment occupies the Columbia River Basin, including the mainstem and all tributaries, to the U.S.-Canadian border (except the Jarbidge River population segment in Nevada). Within the project area, Keechelus Lake and many of its tributaries, and the Yakima River and many of its tributaries, support this bull trout population segment (see Appendix D). The Coastal Puget Sound population segment of bull trout encompasses all Pacific Coast drainages between the Columbia River and the Canadian border. Within the project area, bull trout occur in the Lake Washington and Snohomish River Basins.

Table 3.7-1. Presence and Status of Fish that Occur in the Proposal Areas

Common Name	Scientific Name	State & Federal Status[a]
Anadromous Fish		
Chinook Salmon (Upper Columbia River spring run ESU)	*Oncorhynchus tshawytscha*	PFE, K, 2, 3
Chinook Salmon (Puget Sound ESU)	*Oncorhynchus tshawytscha*	PFT, 2, 3
Chinook Salmon (Snake River, fall run ESU)	*Oncorhynchus tshawytscha*	FT, 2, 3
Chinook Salmon (Snake River, spring/summer run)	*Oncorhynchus tshawytscha*	FT, 2, 3
Chinook Salmon (other ESUs)	*Oncorhynchus tshawytscha*	S, 2, 3
Chum Salmon (Puget Sound/Straits of Georgia ESU)	*Oncorhynchus keta*	2, 3
Coho Salmon (all ESUs)	*Oncorhynchus kisutch*	FC, 2, 3
Pink Salmon (all ESUs)	*Oncorhynchus gorbuscha*	2, 3
Sockeye Salmon (Snake River ESU)	*Oncorhynchus nerka*	FE
Sockeye Salmon (all other ESUs)	*Oncorhynchus nerka*	2, 3, R, S
Cutthroat Trout (Sea-run)	*Oncorhynchus clarki*	FC, 3
Steelhead (Upper Columbia River ESU, above Yakima River)	*Oncorhynchus mykiss*	FE
Steelhead (Middle Columbia River ESU including Yakima River)	*Oncorhynchus mykiss*	PFT, S, K
Steelhead (Snake River)	*Oncorhynchus mykiss*	FT
Steelhead (Puget Sound ESU)	*Oncorhynchus mykiss*	3
Dolly Varden (anadromous form)	*Salvelinus malma*	3
Bull Trout (Coastal-Puget Sound population segment)	*Salvelinus confluentis*	PFT, 3
Resident Salmonids		
Rainbow Trout	*Oncorhynchus mykiss*	3, K
Native Redband Trout (interior Rainbow Trout)	*Oncorhynchus mykiss*	S,K
Coastal Cutthroat Trout	*Oncorhynchus clarki clarki*	3
Westslope Cutthroat Trout	*Oncorhynchus clarki lewisi*	3,K
Bull Trout (Columbia River population segment)	*Salvelinus confluentis*	FT, K, S
Eastern Brook Trout	*Salvelinus fontinalis*	
Brown Trout	*Salmo trutta*	
Kokanee Salmon	*Oncorhynchus nerka*	1
Other Species		
White Sturgeon	*Acipenser transmontanus*	2, 3
Green Sturgeon	*Acipenser medirostris*	2, 3
River Lamprey	*Lampetra ayresi*	R
Pacific Lamprey	*Lampetra tridentata*	R
Mountain Whitefish	*Prosopium williamsoni*	
Largescale Sucker	*Catostomus macrocheilus*	
Burbot	*Lota lota*	R
Shorthead Sculpin	*Cottus shotheus*	R
Torrent Sculpin	*Cottus confusus*	R
Sculpins (General)	*Cottus sp.*	
Northern Squawfish	*Ptychocheilus oregonensis*	

Continued

Table 3.7-1. Presence and Status of Fish that Occur in the Proposal Areas

Common Name	Scientific Name	State & Federal Status[a]
Speckled Dace	*Rhinichthys osculus*	
Longnose Dace	*Rhinichthys cataractae*	
Bridgelip Sucker	*Catostomus columbianus*	
Yellow Perch	*Perca flavescens*	
Walleye	*Stizostedion vitreum*	3
Largemouth Bass	*Micropterus salmoides*	3
Smallmouth Bass	*Micropterus dolomieui*	3
Brown Bullhead	*Ictalurus nebulosus*	
Pumpkinseed	*Lepomis gibbosus*	
Pygmy Whitefish	*Coregonus clupeaformis*	1, 2, R
Carp	*Cyprinus carpio*	
Black Crappie	*Pomoxis nigromaculatus*	
Western Brook Lamprey	*Lampetra richardsoni*	
Bluegill	*Lepomis macrochirus*	
Three Spined Stickleback	*Gasterosteus aculeatus*	
Goldfish	*Carassius auratus*	
Redside Shiner	*Richardsonius balteatus*	
Leopard Dace	*Rhinichthys falcatus*	
Mountain Sucker	*Catostomus platyrhynchus*	
Longnose Sucker	*Catostomus catostomus*	
Peamouth	*Mylocheilus caurinus*	
Lake Chub	*Couesius plumbeus*	
Chiselmouth	*Acrocheilus alutaceus*	
Channel Catfish	*Ictalurus punctatus*	3
Sandroller	*Percopsis transmontana*	2
White Crappie	*Pomoxis annularis*	

Source: WARIS (WDFW 1995)

[a] State priority designations: 1 = listed and candidate species, 2 = vulnerable aggregations, 3 = important recreational or commercial species.

FC = federal candidate
FE = federally listed as endangered
FT = federally listed as threatened
PFE = proposed for federal listing as endangered
PFT = proposed for federal listing as threatened
S = sensitive species (USFS, BLM)
K = listed as key salmonid by the Interior Columbia River Basin Ecosystem Management Project (ICRBEMP)
R = listed as narrow endemic or special status fish by ICRBEMP

The middle Columbia River steelhead ESU was proposed for listing as threatened on March 10, 1998 (63 FR 11797). The middle Columbia River steelhead ESU occupies the Columbia River Basin and tributaries above (but excluding) the Wind and Hood Rivers upstream to and including the Yakima River. Within the project area, the Yakima River mainstem and Cabin, Big, Little, and Swauk Creeks support middle Columbia River steelhead.

The upper Columbia River steelhead ESU was listed as endangered on August 18, 1997 (62 FR 43937). The upper Columbia River steelhead ESU occupies the upper Columbia River Basin from (but excluding) the Yakima River upstream to the U.S.-Canadian border. Within the project area, the Columbia River mainstem and Getty's Cove support upper Columbia River steelhead.

The upper Columbia River spring-run chinook salmon ESU was proposed as endangered on March 9, 1998. Although this ESU occupies areas upstream of the project area (above Rock Island Dam), upper Columbia spring-run chinook salmon would use the mainstem Columbia River in the project area as a migration corridor. The mainstem of the Columbia River, including reaches in the project area, has been proposed for designation as critical habitat for this ESU.

The Snake River steelhead ESU was listed as threatened on August 18, 1997 (62 FR 43937). The Snake River steelhead ESU occupies all of the Snake River Basin. Within the Snake River Basin, the Snake River fall-run chinook salmon (threatened), the Snake River spring/summer-run chinook (threatened), and the Snake River sockeye salmon (endangered) ESU have been also been listed (57 FR 14653, 57 FR 14653, and 56 FR 58619, respectively). Within the project area, the mainstem Snake River near the Pasco Terminal is known to support these ESUs.

Several additional fish species could be listed or proposed for listing within the operational time frame of the proposal. These include coho salmon, sea-run cutthroat trout, and westslope cutthroat trout.

3.7.1.2 Priority and Sensitive Species

Most Washington Priority Species that utilize the proposal area are game or commercial species with locally healthy populations. Sandroller, sturgeon, and pygmy whitefish may form vulnerable aggregations during spawning. However, green sturgeon are unlikely to form these aggregations in the proposal area. Additionally, pygmy whitefish is a relict species found in a few deep glacial lakes in the state, such as Keechelus Lake; the species is protected because of its spotty distribution.

The Northwest Forest Plan has identified a number of salmon, steelhead, and trout populations within the proposal area which are considered species at risk of extirpation. These include chinook salmon, sockeye salmon, steelhead, and bull trout. Bull trout has also recently been identified as a regional sensitive species in the USFS Pacific Northwest Region. The Mt. Baker-Snoqualmie National Forest Plan (USFS 1990a) identifies chinook, coho, pink, and chum salmon, steelhead, searun cutthroat trout, and rainbow, cutthroat, and bull trout as management indicator species (MIS). The Wenatchee National Forest Plan (USFS 1990b) identifies redband trout as sensitive, and westslope cutthroat as an MIS.

The Interior Columbia Basin Ecosystem Management Plan (CBEMP), sponsored by the USFS and BLM, lists all interior Columbia Basin stocks of chinook salmon, rainbow trout and steelhead, bull trout, and westslope cutthroat trout as key salmonids. The scientific assessment for the CBEMP also lists a number of species found in streams along the pipeline corridor as narrow endemic and special-status fish species. Key salmonids, and narrow endemic and special-status fish, are listed in Table 3.7-1.

3.7.1.3 Fish Habitats and Utilization

This section describes conditions and species habitat present within major river drainages within the proposal area. Information provided in the ASC and used for this analysis was obtained from Dames & Moore (1997) WDFW (WARIS), Washington Department of Natural Resources (Data96), and USFS (GIS) databases; stream surveys conducted by OPL; literature sources; and agency contacts. Maps identifying crossing locations are provided in the EIS Map Supplement, and fish utilization at crossings is detailed in Appendix D. The crossing numbers for crossings discussed below are identified in parenthesis.

Sammamish River Basin. The pipeline corridor crosses six channels (1 to 6) within the Sammamish River Basin (a tributary to Lake Washington) including Little Bear Creek (a tributary stream to the Sammamish River) and five unnamed tributaries to Little Bear Creek. The Little Bear Creek crossing (1) provides spawning habitat for coho salmon and summer rearing habitat for coho, chinook, and sockeye salmon, and cutthroat trout. An unnamed tributary crossing (4) provides spawning habitat for coho and rearing habitat for salmon and trout. The other crossings in the basin are not known to support fish. All crossings within the Sammamish River Basin are within the BPA electric transmission line corridor.

Snohomish River Basin. Two stream crossings are proposed in the Snohomish River drainage: Anderson Creek (7) and an unnamed tributary to Anderson Creek (8). A number of barriers and disturbance from construction of the Echo Lake Golf Course likely limit fish use at these crossings. Both streams were dry at the proposed crossing locations during late summer surveys conducted by Dames & Moore.

Snoqualmie River Basin. The Snoqualmie River Basin within the proposal area includes the area drained by the mainstem Snoqualmie River and tributaries, between its confluences with the Snohomish and South Fork Snoqualmie Rivers. Within this basin, the Snoqualmie River and its tributaries can be divided into three subbasins: lower (9 to 21), middle (22 to 27), and upper (28 to 39).

The lower section of the Snoqualmie River includes the lower 19.3 km (12 miles) of the river and its tributaries, from a few kilometers above the City of Duvall to the confluence with the Skykomish River. The proposed crossings within this reach include Ricci Creek (9), the mainstem Snoqualmie River (11), four unnamed tributaries to the Snoqualmie River (10, 10A, 12, and 13), Peoples Creek (14 and 15), two unnamed tributaries to Peoples Creek (14A and 16), the North Fork Cherry Creek (19), two unnamed tributaries of the North Fork Cherry Creek (17 and 18), Cherry Creek (20), and an unnamed tributary to Cherry Creek (21). Except for the approach and departure from the High Bridge mainstem Snoqualmie River crossing, this segment of the pipeline corridor lies within the BPA transmission line corridor.

The lower Snoqualmie River is a migration corridor for chinook, coho, pink, and chum salmon and steelhead (Williams et al. 1975). Only limited spawning habitat is available; however, the Cherry and Peoples Creek drainages support good to excellent salmonid spawning habitat in their lower reaches.

The pipeline would cross the headwaters of Ricci (9) and Peoples (14) Creeks. These small first- and second-order streams are characterized by small, incised footslope channels, moderate gradients, boulder and cobble substrates, and dense stands of riparian vegetation. These stable streams are lacking winter habitat for salmonids but have some summer rearing habitat and patches of spawning gravel. The crossing sites for these streams are not accessible to anadromous salmonids.

The pipeline would cross five streams in the Cherry Creek Basin. The unnamed tributary to the North Fork Cherry Creek would be crossed twice (17 and 18). The stream at the proposed upstream crossing (17) is a moderately steep, confined channel with a baseflow of approximately 0.03 cubic meter per second (m^3/s) (1 cubic foot per second [cfs]). The small, stable stream is dominated by boulders and large cobble substrates and would favor resident salmonid usage. The dense vegetative canopy shades approximately 80 percent of the stream and is dominated by alder and various shrubs. The Cherry Creek channel at the proposed downstream crossing site (18) is a much lower gradient (1.5 percent), moderately confined channel that is dominated by cobble and gravel substrates. This well-shaded stream segment has a bankfull width of approximately 3 m (10 feet) and supports anadromous salmonids. Juvenile coho salmon were observed during the Dames & Moore survey. Chinook, pink, and chum salmon, steelhead and sea-run cutthroat, resident cutthroat, and rainbow trout also use this reach of Cherry Creek.

The North Fork Cherry Creek was dry at the proposed crossing site (19) during summer surveys. Coho and pink salmon use the lower portion of the creek. The proposed crossing site is a wetland and likely provides winter habitat for salmonids.

The mainstem of Cherry Creek is an excellent stream with a good balance of pool-riffle-run habitat types. Cherry Creek is a moderately confined, moderate gradient (2 percent) channel with overhead cover provided primarily by mature alder trees in the fairly wide riparian zone. There is a good mixture of stream substrate sizes. Suitable spawning gravels were located on gravel bars, which would favor use by winter-run steelhead. Other species that utilize the area include coho, pink, and chinook salmon. Summer rearing habitat for anadromous salmonids was observed where the pipeline corridor would cross the mainstem of Cherry Creek (20).

The middle subbasin of the Snoqualmie River includes an 8 km (5-mile) section from Harris Creek to the Tolt River. This reach of the Snoqualmie River provides a migration corridor, areas for adult holding, and rearing habitat for anadromous fish. Chinook, coho, chum, and pink salmon spawn and rear in the mainstem Snoqualmie near Carnation. The section of the Snoqualmie River at the mouth of the Tolt is a primary spawning area for chinook and pink salmon and steelhead (Nelson 1997). Coho and chum also utilize Harris Creek, with chum spawning in the lower 1 km (0.6 mile) (Williams et al. 1975). Harris, Cherry, and Griffin Creeks are highly productive coho streams. Chinook, coho, chum, and pink salmon utilize the lower Tolt River, with chinook and coho salmon and steelhead ascending higher in the watershed to spawn. With the exception of the proposed crossing of the Tolt River, the pipeline corridor lies within BPA and road corridors.

Harris Creek and the Tolt River are the largest tributaries to the mainstem Snoqualmie River that the pipeline would cross between the Cities of Duvall and Carnation. At the proposed Harris Creek crossing (22), the creek is a low-gradient, meandering channel in a wet meadow. The stream is almost completely shaded by alder, dogwood, grasses, and shrubs. The stream substrate is almost

entirely sand/silt and summer baseflow was approximately 0.04 m^3/s (1.5 cfs). This small stream has summer and winter rearing habitat and is utilized by coho salmon and cutthroat trout.

The lower Tolt River is utilized by chinook, coho, chum, and pink salmon and steelhead. At the proposed crossing locations of the Tolt River (26 and 27), the river splits into two distinct channels around an island. The right bank (facing downstream) has been riprapped to protect the county road and private residences during flooding. These moderately confined, high-energy channels are dominated by boulders and cobbles, but spawning gravel was observed on midstream bars. The Tolt River also provides summer rearing habitat for salmon, steelhead, and trout.

The upper Snoqualmie River subbasin includes the mainstem Snoqualmie River and its tributaries from the City of Carnation to its confluence with the South Fork Snoqualmie River. The pipeline would cross several streams in the Griffin Creek (28 to 31) and Tokul Creek (32 to 34) watersheds and the mainstem Snoqualmie River (35 to 39). With the exception of the proposed crossing of Tokul Creek, the crossings would lie within existing BPA, road, and trail corridors.

Chinook, coho, chum, and pink salmon utilize the mainstem Snoqualmie River within this section for migration, spawning, and rearing (Williams et al. 1975). Chinook spawning is intense downstream of Fall City, and some pink and chum salmon also utilize that area. Coho mainly utilize the tributaries, especially Griffin Creek.

In Griffin Creek, the main coho salmon spawning occurs between river miles 3.0 and 5.0. The pipeline corridor would include a crossing of Griffin Creek (28), at river mile 4.3, where the main coho spawning in the stream occurs. The stream is a moderately confined, moderate gradient, footslope channel. Stream substrate is predominantly gravel and cobble, and summer baseflow was approximately 0.04 m^3/s (1.5 cfs). The stream had a bankfull width of about 4.7 m (15.5 feet). Unlike most proposed stream crossings, Griffin Creek has a good amount of large woody debris (LWD) that provides excellent winter habitat for coho salmon and cutthroat trout. The good mixture of pool-riffle-run stream habitats also provides excellent summer and winter rearing habitat for fish.

The pipeline corridor would also cross the headwaters of several small tributaries to Griffin Creek and Tokul Creek (29 to 31 and 32 to 33 respectively), which have summer baseflows less than 0.006 m^3/s (0.2 cfs). At the proposed point of crossing, these tributaries provide little or no fish habitat.

Tokul Creek at the proposed crossing location (34) is a large stream with highly fluctuating flows and heavy bedload movement. The river has a moderate gradient, good pool-riffle-run balance, and suitable substrates for anadromous fish. However, a waterfall located a short distance downstream of the proposed stream crossing location blocks upstream migration of fish. The proposed crossing location provides summer and winter rearing habitat for cutthroat and eastern brook trout. Streambanks are moderately unstable and mature trees are falling into the stream channel. The riparian corridor overstory is dominated by alder and cedar trees. Stream substrate is primarily rubble and cobble, but some spawning habitat was observed by Dames & Moore. WDFW manages a fish hatchery near the mouth of Tokul Creek, approximately 1.6 km (1 mile) downstream of the proposed crossing site. The hatchery water intake is in the Tokul River at that point.

The proposed crossing of the Snoqualmie River (38) would occur approximately 2 km (1.2 miles) above Snoqualmie Falls. Snoqualmie Falls is a barrier to upstream migration of anadromous fish. At the proposed crossing location, the stream provides limited summer rearing habitat for resident fish, primarily rainbow and cutthroat trout.

The pipeline corridor would follow the existing railroad grade and cross Meadowbrook Slough (39) and two unnamed tributaries (40 and 41) to the upper Snoqualmie River. The slough is an old, shallow oxbow of the Snoqualmie River and may support warmwater fish populations. The tributaries are very confined channels that had summer baseflows of approximately 0.03 m^3/s (1 cfs). The streams are almost completely choked with grasses and alders, but could support cutthroat trout.

South Fork Snoqualmie River Subbasin. The South Fork Snoqualmie River subbasin encompasses the area within the South Fork Snoqualmie River drainage to the Snoqualmie Tunnel; it includes 50 proposed stream crossings (40 to 84). The proposed stream crossings within this subbasin generally lie within existing corridors including existing bridges on the South Fork Snoqualmie River, the Cedar Falls Trail, the John Wayne Trail, Homested Valley Road, and Tinkham Road. Portions of the alignment in this subbasin lie within BLM and USFS lands including two stream crossings on BLM lands and 20 stream crossings in the Mt. Baker-Snoqualmie National Forest (see Appendix D for federal ownership at crossings).

This section of the pipeline corridor lies entirely above Snoqualmie Falls which blocks upstream migration of anadromous salmonids. No natural utilization by anadromous salmonids occurs within this section.

The pipeline corridor would cross the mainstem of the South Fork Snoqualmie River twice (42 and 43). Rainbow and cutthroat trout are present in the river at both proposed crossing locations. Both sections of the river provide some trout rearing habitat. At the lower crossing (42), the channel also appears to have some suitable trout spawning habitat.

After crossing the South Fork Snoqualmie River, the pipeline corridor would follow the left bank of the river and cross 48 named and unnamed tributaries. The following discussion of streams at the proposed crossings progresses upstream (easterly) toward Snoqualmie Pass.

The proposed crossing of Boxley Creek (44) would occur approximately 1.3 km (0.8 mile) upstream from its confluence with the South Fork Snoqualmie River. Boxley Creek is an excellent stream for resident trout. Stream habitat types are well balanced, and LWD has created good summer and winter rearing habitat for cutthroat trout. Stream substrate is predominantly gravel, but large amounts of sand/silt were also observed. This may be due to a landslide that enters the creek upstream of the proposed crossing.

East of Boxley Creek, the pipeline corridor crosses 47 first- and second-order streams (named and unnamed) that drain generally northward to the South Fork Snoqualmie River (45 to 84). Most crossings occur within 601 m (2,000 feet) of the South Fork Snoqualmie River mainstem. Most of these streams have very similar habitat characteristics at the proposed crossing locations.

Most of the unnamed tributaries in the South Fork subbasin that would be crossed are small (less than 0.03 m^3/s or 1 cfs), steep drainages, with slopes of 7 to greater than 20 percent. Some provide limited trout rearing habitat at proposed crossing locations and all contribute to water quality in the mainstem.

The named tributaries to the upper South Fork Snoqualmie River include Change (52), Hall (53), Mine (57), Wood (59), Alice (60), Rock (66), Harris (67), Carter (72), Hansen (75), Humpback (78), Olallie (82), and Rockdale (84) Creeks. These streams are quite similar in habitat characteristics, generally steep (5 to 10 percent slopes), and variably incised into unstable glacial till deposits. These channels have naturally unstable banks and high bedload transport rates. Extensive upslope timber harvesting probably has exacerbated these unstable conditions.

Bankfull width ranges from 6 to 9 m (20 to 30 feet). Most of these streams are usually aggraded where the pipeline would cross; however, some streams that have steeper gradients, such as Humpback (78) and Olallie (82) Creeks, appear to be degrading at the proposed crossing locations. Substrates in the South Fork Snoqualmie River tributaries are dominated by large boulders and cobbles, and the summer baseflows are low or intermittent. Riffle is the dominant habitat type.

During past surveys, only a few tributaries to the upper South Fork Snoqualmie River were noted to contain fish (WDFW 1995). However, data collected by the USFS indicate that most if not all of the smaller streams crossed in this section provide some resident trout rearing habitat at or downstream of proposed crossing sites (Paterson pers. comm.).

The mainstem South Fork Snoqualmie River provides rearing and some spawning habitat for rainbow and cutthroat trout. Primarily due to the high gradient, the spawning gravels and bed sediments in this reach of the South Fork Snoqualmie River show little indication of embedded sediments from sediment loading. The primary factor impacting this section of the mainstem river has been the intentional removal of LWD, which accelerates sediment transport to downstream habitats and reduces the number and size of pools and holding water (Pfeiffer 1997).

Yakima River Basin. The pipeline would follow the Yakima River through the middle and upper sections of the basin. The creeks in the Kittitas/Ellensburg area (middle Yakima River) drain irrigated pasturelands and are mixed with numerous irrigation canals and ditches. The creeks draining into the upper Yakima River, including tributaries to Keechelus Lake, are more typical of channels draining forested hillsides. Portions of the alignment in this basin lie within BLM and USFS lands including two stream crossings within BLM lands and 10 stream crossings in the Mt. Baker-Snoqualmie National Forest (see Appendix D for federal ownership at crossings).

Prior to Euroamerican development in the Yakima Basin, anadromous salmonid returns were estimated to have approached 1 million adults annually (Tuck 1994). By 1905, the annual returns had decreased to an estimated 50,000 adults. Although logging, grazing, mining, and other development bear some of the responsibility for this decline, the development of irrigated agriculture was the primary cause.

Traditional water management practices in the Yakima Basin produce extreme low flows in the lower 160 km (100 miles) of the Yakima River. Combined with the elevation of instream

temperatures and the loss of juveniles and adult fish in a poorly screened system of irrigation canals and ditches, the impacts of irrigated agriculture have diminished the river's anadromous fisheries. Sockeye, summer chinook, and coho salmon are extinct in the Yakima Basin (Tuck 1994). Today, the anadromous salmonid runs consisting of spring chinook and summer steelhead total less than 5,000 adults returning annually. There are currently a number of collective efforts underway to restore conditions for chinook salmon and steelhead in the Yakima Basin.

Upper Yakima River. After passing under Snoqualmie Pass via the railroad tunnel, the pipeline corridor follows an existing railroad grade (John Wayne Trail) that crosses 15 tributaries on the west side of Keechelus Lake (85 to 99). Mill (86) and Cold (88) Creeks have similar habitat characteristics. Both streams have concrete arch culverts that are upstream passage barriers for fish. The streams are moderately confined channels with a 2.5 percent gradient. Stream substrate is predominantly cobble and boulder, with small patches of suitable spawning gravel for resident fish. Both streams have fairly heavy bedload movement under higher flows. Riffle is the dominant habitat type, and the proposed crossing areas provide summer rearing habitat for trout and other fish. Under higher flows, fish would not be able to utilize these areas because of high water velocities and the lack of LWD that would create lower velocity winter habitat.

Roaring (97) and Meadow (99) Creeks are also tributaries to Keechelus Lake, and provide more fish habitat than Mill and Cold Creeks. The moderate gradient channels have a good mix of habitat types where the channels are less confined as they approach the lake. Riffle is the dominant habitat type. Cobble is the dominant stream substrate, but suitable spawning gravel is also present.

Cold, Mill, Roaring and Meadow Creeks are accessible from Keechelus Lake, and stream-spawning fish could utilize these areas. The streams are known to contain resident bull trout and westslope cutthroat trout. Keechelus Lake also contains an adfluvial population of bull trout (they rear in lakes and spawn in streams) and westslope cutthroat trout that utilize these streams for spawning. The bull trout population in this lake drainage is considered depleted and is part of the population that has been recently federally listed as a threatened species. Additionally, the lake contains kokanee salmon and a relict population of pygmy whitefish (WDFW priority 1 and 2 species). Both of these fish could use the creeks for spawning. There is no evidence that the pygmy whitefish population in the lake is currently threatened, but the population is isolated. Overall, the proposed stream crossing sites of Keechelus Lake tributaries have summer and winter rearing habitat and fall and spring spawning habitat.

Below Keechelus Lake, rainbow trout were observed in Mosquito Creek (103). Although it appears to have little spawning habitat, the creek provides both rearing and winter refuge for salmonids.

Stampede Creek (104) is mostly a marshy wetland immediately upstream of the railroad grade. The culvert allows water passage only at high flows. The creek provides considerable spawning and rearing habitat for trout below this marshy area and provides good habitat for rainbow trout.

Several unnamed tributaries (105 to 116) which drain to the mainstem of the Yakima River between Stampede (104) and Cabin (117) Creeks appear to have little fish habitat at the proposed crossing locations, but they contribute to water quality in the mainstem.

The pipeline corridor would cross Cabin Creek along the John Wayne Trail. At the proposed crossing location (117), Cabin Creek is a low-gradient footslope channel dominated by cobble/rubble substrates. The creek is downcutting and has a heavy bedload movement during high flows. The creek lacks woody debris and overhead cover. The streambanks are sparsely vegetated by cottonwood and alders, and most vegetation is outside the bankfull channel. The mainstem of Cabin Creek has summer rearing and marginal spawning habitat for resident and anadromous salmonids at and downstream of the proposed pipeline crossing. Cabin Creek also has extensive upstream spawning habitat and provides valuable winter refuge for salmonids, including spring chinook salmon, summer steelhead, bull trout, and rainbow, westslope cutthroat, and eastern brook trout.

An unnamed tributary to Cabin Creek flows out of an old beaver dam pond that is adjacent to the John Wayne Trail, which is at the proposed pipeline crossing location (118). The pond contains excellent habitat for fish. Floating and submerged woody debris, standing snags, and floating and emergent aquatic vegetation provide cover habitat for adult trout. The pond is surrounded by alder and conifer trees. The pond outlet follows the railroad grade, turns downstream under the Cabin Creek Bridge, and enters Cabin Creek approximately 60 m (200 feet) downstream. The pond and outlet creek provide summer and winter rearing habitat.

The pipeline would cross three unnamed tributaries (120 to 122) to the upper Yakima River between Cabin and Tucker Creeks. These small first-order streams have little summer or spawning habitat value, but they contribute high-quality water to the Yakima River and provide winter refuge for trout.

Tucker Creek (124) is a moderately confined, low-gradient channel dominated by gravel substrate. The creek is actively downcutting due to removal of LWD and riparian vegetation associated with residential property clearing. The water temperature was warm (63°F, 17°C) in August 1995. During normal years, an upstream water user diverts the entire flow of the creek. There is spawning and limited summer rearing habitat for rainbow trout at the proposed crossing site.

The pipeline would cross Main Canal twice (123 and 125), on either side of Tucker Creek. Although it contains a few salmonids that enter through poorly screened irrigation diversions, no spawning or rearing habitat exists in the canal.

Big (127) and Little (129) Creeks have been affected by the clearing of vegetation under the electric transmission lines. The channels are actively moving laterally and/or downcutting in the vicinity of the proposed crossings. Big Creek is a moderate gradient, moderately confined channel dominated by cobble substrates. Little Creek is moderately confined, but has a higher gradient channel (6 percent). The streambanks are dominated by shrubs and small trees such as alder, cottonwood, willow, and vine maple. Both streams lack LWD and instream cover is low. Both creeks provide spawning and summer rearing habitat for salmonids. Spring chinook salmon, summer steelhead, rainbow trout, and westslope cutthroat trout are present in both streams.

Downstream of Little Creek, the pipeline corridor would cross several small tributaries of the Yakima River within or immediately adjacent to the BPA corridor before the pipeline would cross the mainstem. These tributaries are Peterson (130), Granite (131), Spec Arth (132), Tillman (133), and Thornton (143) Creeks and 11 small unnamed drainages (134 to 142, 144, and 145). These first-

and second-order streams have predominantly sand substrates. Streambank vegetation is primarily grasses and emergent aquatic plants, with some small trees and shrubs. During the Dames & Moore surveys, the streams either had low baseflow, less than 0.03 m^3/s (less than 1 cfs), or were dry. They have limited fisheries value but contain resident rainbow trout and provide winter refuge habitat.

At the proposed crossing location of the Yakima River (147), the bankfull width is approximately 60 m (200 feet). The well-confined channel was near bankfull during the Dames & Moore field surveys. The 1 percent gradient, meandering channel has a good mixture of stream substrates and is predominantly riffle habitat. Boulder and cobble substrates dominate the center of the channel. The stream margins have mainly rubble, gravel, and sand substrates. Streambanks are lined with willow, alder, and cottonwood trees. The upper Yakima River is an important spawning and rearing area for anadromous and resident salmonids and provides habitat for spring-run chinook salmon, summer-run steelhead, bull trout, and rainbow, westslope cutthroat, eastern brook, and brown trout.

Middle Yakima River. The creeks in central Kittitas County drain flood-irrigated pasturelands and are intermingled with numerous irrigation canals/ditches. The creeks are heavily channelized, frequently culverted, regularly excavated, and often turbid. The riparian areas are very narrow to non-existent. These creeks are managed primarily for water conveyance.

Despite these limitations, some of the creeks the pipeline would cross have fisheries value. The areas above the proposed pipeline crossings and the irrigation diversions usually contain good populations of resident westslope cutthroat trout. The lower reaches near the Yakima River contain fishable populations of rainbow trout with over-wintering and limited trout spawning occurring. However, only a few fish are found in the creek midsections where the pipeline would cross.

Swauk Creek (151) is a low-gradient, moderately confined channel dominated by gravel substrates. The valley bottom width is greater than 150 m (500 feet). The channel is unstable and shows signs of dramatic channel shifts and downcutting, due in part to historic upstream mining activity, and heavy livestock grazing along the streambanks. The channel lacks LWD and overhead cover. Sideslopes are steep, composed of sand/silt sediments, and sparsely vegetated. Although in degraded condition, portions of Swauk Creek provide rearing habitat for spring chinook salmon, and spawning and rearing habitat for summer steelhead, bull trout, and rainbow, westslope cutthroat, and eastern brook trout.

The pipeline would cross Dry Creek four times (156, 157, 160, and 161). Dry Creek is a moderately confined, unstable channel. The substrate is dominated by cobbles. Willows and grasses dot the streambank. The creek was dry during the Dames & Moore survey and provides little if any summer rearing habitat. This watershed is subject to winter flooding and probably contributes heavy sediment loads to the Yakima River. It is possible that the lower reaches of Dry Creek provide winter refuge for salmonids.

Wilson (187) and Naneum (190 and 193) Creeks both provide habitat for rainbow trout. Wilson Creek is a low-gradient, meandering, floodplain channel. The substrate is cobble dominated. Grasses, cottonwoods, and willows provide relatively wide, stable riparian areas. Grasses line moderately stable streambanks.

Naneum Creek (190 and 193) and the unnamed tributary to Naneum Creek (192) are cobble-dominated channels, with moderate gradients and confinement. The grass-lined streambanks are moderately stable. The creek is lined by intermittently spaced willows and cottonwoods. Both streams have high water temperatures, limited summer rearing and spawning habitat for salmonids, and serve as winter refuge for juvenile salmonids.

Parke Creek (201, 205, 206, and 1-A), Coleman Creek (196), Currier Creek (180), and Reecer Creek (166) provide poor habitat conditions for salmonids in the proposal area. These creeks are highly channelized with little riparian vegetation or overhead cover. The warm water often runs turbid and near bankfull with irrigation water. These creeks have limited rearing and spawning habitat for rainbow trout, but provide some winter refuge for juvenile chinook salmon and rainbow trout.

Columbia River Basin. Within the Columbia River mainstem area, the proposal includes crossings of streams and irrigation canals within the Ryegrass Coulee, Rocky Coulee, mainstem Columbia River, and lower Crab Creek watersheds.

The Ryegrass and Rocky Coulee drainages are not known to support significant fish populations.

The proposed Columbia River crossing would be located just downstream of Wanapum Dam (223). This area is influenced by dam discharges and the backwatering effects of Priest Rapids Lake. The streambanks are composed of cobble and gravel substrates and have little vegetation. Because of dam discharges, the stream habitat is primarily run and riffle. The proposed crossing site probably provides spawning and summer rearing habitat for anadromous salmonids, especially fall chinook salmon. Other species of anadromous salmonids, including summer/spring chinook and summer steelhead, migrate past the crossing site. Other salmonids including bull trout and rainbow trout are also present at the crossing location. Other important species that may occupy this reach of the Columbia River include bass, walleye, white sturgeon, and sandrollers. These species could also be present in Getty's Cove.

OPL is also considering four other alternative crossings of the Columbia River including dredging a crossing north of I-90, attaching the pipeline to the I-90 Bridge, crossing Wanapum Dam, or attaching the pipeline to the Burlington Northern Beverly Railroad Bridge. A number of salmonid and non-salmonid fish species could be present at alternative Columbia River crossing locations, including spring, summer, and fall chinook salmon; steelhead; bull trout; rainbow trout; largemouth and smallmouth bass; walleye; catfish; white sturgeon; sandroller; and numerous other resident fish species.

The proposed crossing sites on lower Crab Creek (244) and its unnamed tributaries (230 to 232, 234, and 236 to 243) are near the Columbia National Wildlife Refuge (crossing 241 is on Refuge land). The streams drain adjacent crop/rangeland and are managed for water conveyance. These low-gradient, meandering channels are dominated by sand substrate (assumed from streambank composition) and have little habitat diversity. The streambanks are dominated by grasses and are stable. The creek does not provide habitat for salmonids in this area, but it provides a winter refuge for salmonids downstream near its confluence with the Columbia River. Historically, lower Crab Creek provided habitat for interior rainbow (redband) trout and steelhead, but it is doubtful if any native fish still exist in the watershed.

At various times, hatchery steelhead have been planted in Crab Creek. A trout hatchery exists on Rocky Ford Creek in the headwaters of Crab Creek above Moses Lake. Rocky Ford Creek at one time had a variety of cutthroat trout that is now extinct. Rocky Ford Creek and Crab Creek below Potholes Reservoir have spawning populations of introduced rainbow and brown trout.

Crossings of lower Crab Creek that were added as part of the proposal to avoid the Corfu Landslide (H26-c, H26-d, and H26-e) are close enough to Marsh Units 1 and 2 in the Columbia National Wildlife Refuge that rainbow and brown trout stocked in the units find their way down to the creek in the vicinity of these proposed crossings.

The pipeline corridor would cross 38 large and small irrigation canals in this area. Some of the large canals include Main (123 and 146), North Branch (174), Cascade (194 and 203), Highline (207), Royal Branch (233 and 235), Wahluke Branch (258), Eltopia Branch (274), and Esquatzel Diversion (283). Some are lined with concrete, especially where the crossing is near an existing road. These waterways have limited salmonid value. The various canals, ditches, and coulees are warmwater environments that have supported yellow perch, black crappie, pumpkinseed, brown bullhead, largemouth bass, sculpin, and bluegill. Occasional stocked trout from pothole lakes are found in the canals, but reproducing populations of trout do not exist in any of the canals. The straight, featureless canal channels have smooth bottoms and elevated water temperatures. Riparian vegetation along the canals is usually sparse or non-existent due to canal maintenance. These characteristics result in poor habitat in most cases for any kind of fish.

Eagle Lake and Esquatzel Coulee are natural, though modified, water bodies that do not contain salmonids. Eagle Lake drains into the Columbia River, and the Ringold Hatchery is located at the confluence. Most of the flow of Esquatzel Coulee is diverted into the Esquatzel Diversion Channel upstream of the proposed pipeline crossing location.

3.7.2 Environmental Consequences

3.7.2.1 Proposed Petroleum Product Pipeline

Fisheries could be directly or indirectly affected by construction or operation of the proposal. Potential impacts on fish habitat and populations range from physical or chemical changes in water quality, to changes in flow or access, to loss or degradation of physical fish habitat.

Construction Impacts. Construction activities could cause a variety of impacts, including increased turbidity and sedimentation, physical disturbance of fish habitat, effects from hydrostatic test water discharge, accidental spills of drilling muds or hazardous materials, blasting (if required), and blockage of fish migration. Potential construction impacts, including possible effects on special-status species, are described in detail in the following sections.

Turbidity and Sedimentation. Construction of the pipeline would result in increased sediment loading to surface waters crossed or adjacent to the pipeline corridor. The sources of sediment would include in-channel trenched crossings and surface runoff from disturbed upland and

riparian areas. Overall, sediment transport to streams during construction of the pipeline is expected to result in a minor, temporary impact to fish from turbidity (lasting hours to days), and a moderate, short-term impact to fish and their habitats from sedimentation (lasting less than 3 years).

Increased sediment loading could affect aquatic biota through increases in turbidity associated with the transport of fine-grained material in the stream, and through deposition of sediment in downstream areas resulting in reduced habitat value for fish and their prey. Suspended sediments, if concentrated, could cause mortality or injury of fish, temporarily reduce feeding efficiency, and/or reduce prey availability. Of particular concern is sedimentation of suspended material within spawning areas. Sedimentation in spawning areas could smother fish eggs or larvae (if present at the time of construction), or lower the quality or quantity of spawning areas by embedding fine sediment in spawning gravels. A detailed discussion of water quality impacts from increased sediment loading is in Section 3.6, Water. The following discusses fishery impacts due to changes in water quality and sediment regimes. Potential impacts are based on the proposal by OPL, including BMPs (see Appendix C).

The severity of impacts from construction-generated sediments at individual crossing sites would depend on several factors including crossing method; types of fish and habitat present at and downstream of the proposed crossing site; amount of bed, bank, and riparian area disturbance; stream and bank gradient and erodibility; number of crossings within basins; effectiveness of erosion control BMPs; and weather and streamflow conditions. Habitats at greatest risk are those containing spawning habitat for salmonids and other sensitive fish species where in-channel construction is proposed (Table 3.7-2).

OPL has identified 293 stream crossings that would be required for the proposal. OPL proposes to use non-invasive construction methods at 127 proposed crossings, including installation over or under culverts, attaching the pipeline to bridges, or boring or directionally drilling the crossings. Where non-invasive crossing methods are proposed, standard BMPs would include erosion control measures, appropriate storage and containment of trench spoils, and placement of secondary containment structures (e.g., filter fences, weed-free hay bales, sand bags) downslope of construction areas (see "Accidental Spill of Drilling Muds" below for a separate discussion of potential impacts associated with drilling and boring). Although these methods are not 100 percent effective, implementing these BMPs at sites proposed for non-invasive crossing would reduce the potential for sediment transport impacts on fish or fish spawning/rearing habitat to a minor level.

OPL proposes to use invasive methods at 161 to 166 crossing sites (crossing methods to be used at 5 sites are currently undecided and are proposed as being either invasive or non-invasive). Invasive methods include trenching dry channels, flume and trench, divert and trench, and wet trench. Sixty-five streams for which invasive methods are proposed provide fish habitat at or just downstream of the proposed crossing location (see Appendix D). Additionally, 18 of the 65 crossings with fish habitat contain salmon or trout spawning habitat at or just downstream of the proposed crossing site (Table 3.7-2).

Table 3.7-2. Proposed Invasive Stream Crossing Sites with Salmonid Spawning Habitat Present at or just Downstream of Site

Stream Name	Crossing Number	Land Ownership	Type of Spawning Habitat Present
Cherry Creek	20	Private	salmon
Tolt River	26 & 27	Private	salmon
Griffin Creek	28	Private	salmon
Boxley Creek	44	Private	trout
Mine Creek	57	Private	trout
Roaring Creek	97	USFS	bull trout, kokanee, white fish
Meadow Creek	99	USFS	bull trout, kokanee, white fish
Mosquito Creek	103	USFS	trout
Cabin Creek	117	Private	salmon
Tucker Creek	124	Private	trout
Big Creek	127	Private	salmon
Little Creek	129	USFS	salmon
Granite Creek	131	Private	trout
Yakima River	147	Private	salmon
Swauk Creek	151	Private	steelhead, bull trout, cutthroat
Reecer Creek	166	Private	trout
Currier Creek	177	Private	trout

OPL evaluated the feasibility of using non-invasive crossing methods (boring, horizontally drilling, or bridging) to avoid in-channel impacts at stream crossing locations with spawning habitat, or that provide habitat for salmon or sensitive species. However, based on OPL's preliminary analysis, these methods were considered infeasible at these sites because of the presence of subsurface rocks, greater upland habitat impacts from staging and construction, access constraints, steep slopes, or vulnerability of an exposed pipeline to damage (OPL 1998).

OPL proposes to use standard in-channel construction techniques, which include BMPs to minimize sediment impacts to water quality and fish habitat (see the surface water impact analysis in Section 3.6 and the ASC for a detailed description of crossing methods). Construction techniques and other measures OPL has proposed to minimize impacts of the project on fish and water quality are detailed in Appendix C. Important features of the construction methods that would minimize fisheries impacts include:

- constructing stream crossings during low-flow, WDFW work windows to minimize the presence of sensitive life history stages of fish (Table 3.7-3);

Table 3.7-3. Construction Timing of Stream Crossings

County	Construction Window
King	June 15 - October 15
Snohomish	June 15 - September 30
Kittitas	June 15 - September 30
Grant	July 1 - September 30
Franklin	July 1 - September 30
Adams	July 1 - September 30
Special Timing Requirements	
Little Bear Creek	June 15 - September 30
Columbia River	October 16 - March 31
Keechelus Lake Tributaries	August 1 - August 15
Yakima River, Swauk Creek	Sept. 1 - Sept. 30 (Sept. 15 - Sept. 30 preferred)
Cabin, Big and Little Creeks	July 1 - August 31

- narrowing the construction corridor width from 18 to 9 m (60 to 30 feet) within stream channels and riparian areas;

- minimizing sediment transport from active construction sites by constructing crossings when channels are dry, or using flumes or diversions to route water around active construction sites;

- minimizing crossing distance (cross channels perpendicular to flow);

- minimizing equipment disturbance to bed and banks by operating trenching equipment outside the stream channel or, where the stream is too wide, operating equipment from in-channel mats or portable bridges;

- storing trench spoils outside riparian areas and providing secondary containment;

- after bedding the pipeline, backfilling with native material and compacting, except for the top 0.6 m (2 feet) of backfill that would consist of angular material similar in size to existing bed composition;

- maintaining existing channel gradient and habitat characteristics;

- stabilizing streambanks and channel sideslopes;

- slowly releasing water from flume or diversion structures over the construction area to minimize sediment pulse; and

- revegetating the construction corridor.

Even with the above construction practices and BMPs, construction of trenched crossings through or above salmonid spawning habitat could result in a moderate impact.

Because construction of these crossings would not occur when sensitive life history stages are present (when fish are spawning, or when eggs or alevins are present in gravels), direct mortality from sedimentation is not expected. However, construction would result in a short-term (generally less than 3-year) reduction in the quality and/or quantity of spawning habitat at some of the proposed crossing locations.

As part of the permitting process, OPL would be required to mitigate any impacts to fish habitat. Mitigation would vary depending on the location and severity of impacts. Mitigation may include preparation of site-specific construction plans for streams containing sensitive fish habitats, construction and post-construction monitoring, replacement of impacted habitat, or enhancement of existing habitat. The design of site-specific crossing plans and mitigation would be coordinated through state and federal agencies.

Physical Disruption of Habitat. Depending on the location and construction methods used, physical impacts to fish habitat from construction of the pipeline could range from moderate to negligible. This impact category includes alteration of fish habitat such that it is physically modified or unusable for some period of time following construction.

Non-invasive crossing methods are less likely to physically disturb fish habitat. Impacts to fish habitat from non-invasive crossing methods would be limited to a potential temporary increase in sediment loading during the construction period (see "Turbidity and Sedimentation" above), or with bored or drilled crossings, the potential risk of a bentonite seep (see "Accidental Spill of Drilling Muds" below). Because of the BMPs included for construction (see Appendix C), sediment transport to streams from non-invasive crossing should be minimized and physical impacts would be minor to negligible.

At sites where invasive methods are proposed, physical channel and riparian disturbance would occur. These impacts would include:

- short-term alteration of stream structures, banks, and substrates within a 9 m (30-foot) wide construction corridor within the stream channel;
- short-term degradation of habitat from sedimentation (see above);
- short-term loss of riparian vegetation from a 6 m (20-foot) section of each bank; and
- long-term loss of riparian vegetation from a 3 m (10-foot) section of each bank that would remain cleared for maintenance of the pipeline.

The direct impact of trenched crossings would be disturbance of a 9 m (30-foot) wide corridor within stream channels. In flowing channels, a number of BMPs would be used to minimize

disturbance area and sediment transport from the site (see previous discussion of sediment transport impacts). It is expected that substrates in the disturbed area would resemble natural conditions within 3 years as a result of natural hydrologic processes. This could result in locally reduced fish rearing and spawning habitat quality during that period.

Even with effective implementation of BMPs described here and in Section 3.6, Water, some physical impact of sedimentation downstream of the proposed crossing sites is inevitable. Physical impacts due to sedimentation could range from none to moderate. The extent and severity of sedimentation impacts would depend on a number of factors as discussed in the previous section.

Short- and long-term fish habitat impacts resulting from riparian vegetation removal are expected to be none to minor with implementation of BMPs. In most cases, the types of vegetation to be removed during construction range from none (road or trail beds) to shrubs. However, some trees would be cleared from the 9 m (30-foot) corridor at 22 proposed crossing sites. In the early planning process for the proposal, OPL adjusted the pipeline corridor at several crossings to avoid high-quality riparian areas (primarily trees) and to minimize impacts of riparian vegetation removal. The amount of riparian vegetation to be removed within the construction corridor would be minor in relation to that present in the drainage, and would not substantially alter stream temperatures or LWD recruitment.

All disturbed upland and riparian areas would be planted with approved seed mixtures to reduce post-construction erosion. Riparian areas would be replanted with native shrubs and/or trees, with the exception of a 3 m (10-foot) corridor required for pipeline maintenance. Bank stabilization and revegetation would be monitored and rectified (if necessary) to minimize the potential for long-term impacts (see Section 3.3, Botanical Resources, and Section 3.6, Water).

Hydrostatic Test Water Discharge. Hydrostatic testing of the pipeline at individual stream crossings, testing of the entire pipeline, or testing of storage tanks at the Kittitas Terminal would have negligible impacts on water quality and quantity (see Section 3.6, Water). Therefore, such testing would likely result in negligible impacts to fish or fish habitat.

Accidental Spill of Drilling Muds. OPL proposes to bore crossings at 40 to 44 sites and horizontally drill at one site, the Columbia River. If substantial seeps of drilling muds occurred at the proposed drilled crossing of the Columbia River, impacts to fish and their habitat would likely be moderate. Because of the low fish use within the canals, the probability of impacts to fish at those sites would be negligible to minor.

Occasionally, when crossings are bored or directionally drilled, drilling muds can seep to the surface, potentially resulting in impacts to fish or habitat if muds seep to or are conveyed to streams. Muds could also be conveyed to streams from staging areas. Bentonite, a clay-based mixture, is the most common lubricant used for boring and drilling, and is generally non-toxic. Polymers can also be used in some cases. The mud is pumped down the bore head to lubricate the boring mechanism. When pump pressures are sufficiently high (pressure generally increases with the diameter or distance of a bore), and the bore encounters fractures in the underlying rock, drilling muds may seep to the surface. If seeps occur in a flowing stream channel or if the muds are conveyed to a flowing stream,

turbid conditions and sedimentation in the stream could result. This could affect fish by temporarily degrading water quality and potentially affecting fish habitats and prey by sedimentation.

As described in Appendix C, OPL would implement a number of BMPs to minimize the potential of drilling mud conveyance to stream channels, and consequent impacts to aquatic habitats, including:

- geologic survey of proposed bore or drill crossing sites to verify that the method is viable;
- preparation of site-specific construction plans for areas with sensitive resources;
- confined area of disturbance for staging areas;
- installation of primary and secondary sediment confinement between the staging areas and waterways; and
- preparation of a Spill Prevention, Control, and Countermeasure (SPCC) plan that would include close monitoring of drilling mud pressures and downstream waters to rapidly detect seeps and implement spill containment and contingency plans.

Accidental Spill of Hazardous Materials. Direct spills of toxic substances (fuel, oil, or other construction-related compounds) into streams could harm fish, depending on the quantity and concentration of the spilled material. Hazardous materials associated with the construction of the proposal would be limited to substances used for construction equipment, such as gasoline and diesel fuels, engine oil, and hydraulic fluids.

Potential water quality impacts of hazardous materials spills are discussed in detail in Section 3.6, Water. OPL would prepare an SPCC plan to minimize the potential for accidental spills of hazardous materials and, if they occur, to contain and clean up spills. The risk of direct spills and the potential for surface or groundwater contamination would be substantially reduced because fuel and other hazardous materials would be stored in staging areas at least 30 m (100 feet) away from any water body. Additionally, refueling, equipment servicing and maintenance, and storage of equipment would not occur within 30 m (100 feet) of any water body.

If a spill should occur, it would be contained and contaminated soils would be removed to an appropriate facility for treatment and/or disposal. The appropriate regulatory agencies would be notified immediately of any spill and cleanup procedure.

Acoustic Shock to Fishery Resources. Although not yet identified as being necessary, it is probable that construction within some areas in or near streams may require blasting bedrock. The detonation of explosives in or immediately adjacent to fish habitat could cause disturbance, injury, or death to fish and destruction or alteration of their habitats.

Blasting can affect fish by two different mechanisms depending on where charges are placed (Wright 1982). If the charge is detonated in water, it produces a post-detonation compressive

shockwave which can rupture the swim bladder (a gas-filled organ which maintains fish buoyancy) or affect other organs. Fish eggs and larvae can also be affected by this pressure wave. When a charge is detonated next to fish-bearing waters, the charge sets up a vibration, which may damage incubating eggs.

Potential impacts of blasting (if it is required) could range from major to none depending on the location and timing of the explosion (Wright 1982, 1994). The impact would be major if it resulted in the mortality of federally listed or proposed species, or if it occurred in an area that affected concentrations of salmon or their eggs or fry. The impact would be low to none if it occurred in or near non-fish-bearing waters or waters with poor fish habitat. In general, mechanical excavation is preferable to blasting if fish are in the immediate area.

Based on studies conducted by the Canadian government (Munday et al. 1986), measures to reduce the impact of blasting may include:

- a thorough evaluation of the objective of blasting to ensure that blasting is the only method available;

- careful planning of the blast program to minimize the size and damaging effects of charges;

- removing and excluding fish from areas potentially affected by the blast through electroshock capture or other methods; and

- timing the blasting program to avoid periods of high fish presence.

If blasting is required in or near fish-bearing streams, OPL would contact appropriate permitting agencies to meet requirements. If blasting is required in or adjacent to streams supporting federally listed or proposed species, OPL would also be required to contact USFWS and/or NMFS. Construction, including blasting in or near streams, would only be performed during authorized in-water work windows based on WDFW procedures for the protection of salmon and their eggs (see Table 3.7-3). OPL has indicated that resident fish would be removed from stream crossing areas when blasting is necessary. Procedures to follow if blasting is required would be clearly defined in the Section 404/10 permit, USFS and BLM plans of development, or other approvals.

Guidelines developed by the Canadian government (Wright 1994) may be useful in preparation of blasting plans and other additional measures to minimize or avoid potential fish impacts. (See the "Additional Proposed Mitigation Measures" at the end of this section.)

Blockage of Fish Movement and Migration. The proposal is expected to result in negligible impacts in regard to the blockage of fish movement or migration. Fish movement would be restricted at invasive crossing sites during construction; however, most crossings would be completed within a few days, and construction would be timed to avoid important migrational periods of fish. Larger river crossings such as the Tolt and Yakima Rivers and Getty's Cove would take longer to construct (1 to 2 weeks). Diversions which would only block a portion of the channel would be used for larger invasive crossings. Diversions could impede fish movement, but movement

would not be completely blocked during construction. Again, construction of these crossings would occur outside important migration periods.

The proposal does not include the placement of new permanent culverts, but temporary culverts may be installed to facilitate equipment movement during construction and some culverts may be replaced. Temporary culverts would be removed after construction, and stream channels at culvert and crossing locations would be restored to pre-construction conditions. Thus no residual blockage of fish movement corridors is anticipated. If existing culverts are replaced at agency request due to poor condition, inadequate sizing, or as additional mitigation (see below), culverts would be designed to maintain fish passage.

Federally Listed or Proposed Threatened or Endangered Fish Species. Federally listed fish species or fish species proposed for listing could be affected by the proposal (see Table 3.7-2). Impacts to these species are expected to be none to moderate with the implementation of BMPs.

Puget Sound Chinook Salmon. The Snoqualmie River mainstem, the Tolt River, and Cherry and Harris Creeks support Puget Sound chinook salmon, which has recently been proposed for listing as threatened. With the exception of the Snoqualmie River crossing (which would be bridge attached), invasive crossing methods would be used at these crossing locations (fluming or diverting water around the crossing site during construction). Spawning habitat for Puget Sound chinook salmon is present at the Tolt River and Cherry Creek crossing sites. Invasive crossing methods used at these sites would have a moderate impact on physical spawning habitat.

As discussed earlier in this section, OPL proposes to use standard construction BMPs to minimize potential water quality and physical habitat impacts to fish, including those federally listed and species proposed for federal listing. Construction timing would avoid sensitive periods when fish are spawning or migrating, or when eggs or aleviens are present in gravels. However, there would be a short-term (generally less than 3 years) impact on the available quantity and quality of spawning areas at each site. If construction occurs after the species is officially listed, the construction at these sites could constitute a "take" of the species. Issues of "take" would be evaluated as part of Section 7 consultation for the project. As part of the permitting process, OPL would be required to design crossings to avoid impacting federally listed species. Mitigation for any short-term loss of habitat would be negotiated with NMFS and WDFW.

Columbia River Bull Trout. The Columbia River bull trout population segment has been federally listed as threatened. Bull trout populations are present in areas potentially affected by the proposal including Keechelus Lake, the Yakima River, the Columbia River, and several of their tributaries (see Appendix D). It is also possible that bull trout populations may utilize other streams in the Yakima Basin that would be crossed by the pipeline corridor. WDFW is presently surveying the Yakima River Basin for bull trout and would likely find additional populations.

The proposed pipeline corridor along Keechelus Lake lies within the John Wayne Trail, and crosses 4 named and 11 unnamed tributaries to the lake. OPL proposes over- or under-culvert crossings for all unnamed streams and Mill and Cold Creeks (86), and diversion and trenching of

Roaring (97) and Meadow (99) Creeks. Construction of stream crossings using non-invasive methods is expected to have negligible to minor impacts on bull trout with effective implementation of BMPs. Construction of crossings would occur during the USFS preferred construction window of August 1 to August 15 between the emergence of spring spawning salmonid fry and bull trout spawning activity, which would minimize the potential for a take of this species. Because this window can shift due to weather conditions each year, OPL will verify construction timing with USFS during the year of construction.

Diverting and trenching crossings of Roaring and Meadow Creeks could have a minor to moderate but localized impact on bull trout spawning habitat below the proposed crossing sites. Even with implementation of BMPs, some sediment from construction is likely to be deposited in these spawning areas. Substrate data from the channels of Roaring and Meadow Creeks below the crossings have not been gathered at this time. Alternative non-invasive crossing methods are being evaluated for these crossings. Based on preliminary reports, boring or directional drilling below the streambed at these crossings would not be feasible due to subsurface rock, and the existing bridges are inadequate for supporting the pipeline (Dames & Moore 1997).

Alternative crossing methods are being considered for Cabin Creek (117), Yakima River (147), and Swauk Creek (151) because they are known to support bull trout. Preliminary reports indicate that boring or drilling would not be feasible at Cabin Creek due to subsurface rock, and the existing bridge is inadequate for supporting the pipeline. Boring would not be feasible at the Yakima River crossing because the water table is shallow, the site would be too constricted for drilling, and no access would be available on the west side. Boring would not be feasible at the Swauk Creek crossing due to the required depth of the launch and receive pits, impracticality of drilling in subsurface rock and on steep slopes, and technical infeasibility of bridge construction.

Species Present at Columbia River Crossing. Upper Columbia River steelhead (endangered), Upper Columbia River chinook salmon (proposed endangered), and middle Columbia River steelhead (proposed threatened) could be present at the crossing of the Columbia River and at Getty's Cove. Horizontal drilling of the Columbia River crossing would result in minimal impacts to listed and proposed salmonids. However, as discussed earlier, there is some potential for seepage of drilling muds to water bodies crossed using drilling or boring methods. If conditions appear feasible and agency approval is granted, OPL would also implement drilling BMPs to identify seeps should they occur. These BMPs include close monitoring of drilling fluid pressures, and monitoring water conditions downstream of the crossing site.

All fish species found in this reach of the Columbia River could be present in Getty's Cove, including federally listed or proposed species. OPL would cross this cove using the divert and trench method. Construction of the crossing would resuspend sediments, temporarily increasing turbidity and possibly pollutant concentrations, and could lower dissolved oxygen due to the relatively confined nature of the cove. Impacts to fish could range from minor to moderate.

Species Present at Snake River. Threatened spring/summer and fall-run chinook salmon and endangered sockeye salmon are present in the Snake River near the terminus of the pipeline corridor. The proposal is not expected to result in negative impacts to these species because construction would not affect water quality or habitat within the Snake River.

Construction Impacts - Columbia River Approach Options. There are no significant fisheries resources within the segment of the pipeline corridor affected by the proposed YTC route (crossings 1-A to 1-M) or the alternative YTC segment options (crossings 207 to 215).

Construction Impacts - Columbia River Crossing Options. In addition to the proposed Columbia River crossing method (horizontally drill a crossing below Wanapum Dam), OPL has identified four alternative Columbia River crossing routes: dredging a crossing north of I-90, attaching the pipeline to the I-90 Bridge, crossing the Wanapum Dam, or attaching the pipeline to the Burlington Northern Beverly Railroad Bridge. There are also various approach routes to the alternative crossing sites.

The alternate routes for the dredged and I-90 crossings of the Columbia River continue east on the north side of I-90, cross the river, and continue south along the east side of the Columbia River, rejoining the proposed alignment approximately 25 km (4 miles) east of Wanapum Dam. With the exception of the Columbia River, streams crossed by these two alternative routes (crossings 24a to 24c) do not appear to provide fish habitat. Fish, including federally listed and proposed species, do occur in this reach of the Columbia River. There would be negligible impacts to fish if the pipeline crossed the Columbia River via the I-90 Bridge, the Burlington Northern Bridge, or Wanapum Dam. Impacts to fish from crossing the Columbia River via a dredged crossing would be greater than the proposed drilled crossing, and could be moderate to major. Dredging the Columbia River would result in resuspension of sediments, temporarily increasing turbidity and possibly pollutants which could affect fish.

There are also several alternative approach routes which originate north of I-90 and extend to the proposed crossing location (crossing 223) and the Burlington Northern Railroad Bridge crossing. None of the streams crossed by these alternative alignments provide fish habitat with the exception of the alternative route segment which crosses Johnson Creek (crossing 222). Johnson Creek is known to provide salmon spawning habitat.

Operational Impacts. Operational impacts on fisheries are those impacts resulting from maintenance or operation of the proposal. Routine maintenance activities would normally be minimal, including inspection of the pipeline corridor and occasional vegetation management within a 3 m (10-foot) wide corridor. Under normal conditions, operation of the proposal should have no to minor effects on fisheries. However, an accidental spill from the pipeline, depending on the location and severity, has the potential to have a major impact on fisheries.

Biological impacts of a spill include direct impacts of the spilled product on the organism (e.g., acute or chronic toxic effects and smothering). Other important impacts include modification of habitat by destroying or damaging vegetation, or modification of in-channel habitats important for fish spawning or rearing either by the spill or through the cleanup efforts (e.g., removing contaminated soil or building access roads or fire breaks). A spill or cleanup could also affect organisms that serve as food for fish.

Spill scenarios for spill events at waterway crossings are presented in the ASC product spill analysis (OPL 1998). The assessment of impact was made using the following five factors:

- the types of products spilled,
- the size of the spill,
- the local conditions at the time and place of the spill,
- the receptors of the impact and their characteristics, and
- the specific emergency response and cleanup activities used.

Scenarios are presented for Little Bear Creeks, Harris Creek, Olallie Creek, Keechelus Lake, Yakima River, Columbia River, and Crab Creek. The ASC product spill analysis concluded that there would be a measurable but small probability of spills from the proposed pipeline at waterway crossings. If spills occur at waterways, fish would experience a major but relatively short-term (days to months) impact. Impacts would be more significant if they occurred to a discrete salmonid run or to a listed species, either of which could measurably affect a population. In streams and rivers, impacts can extend to a broad area, but the dynamic nature of the environment also tends to dilute and reduce impacts with time. Long-term chronic impacts are potentially less significant due to naturally occurring mechanisms in the environment that buffer, disperse, absorb, or degrade material introduced to the environment by an accidental release.

OPL would prepare an SPCC plan, including maintenance, monitoring, and emergency management, to minimize the potential and impact of spills (and consequent containment and cleanup activities). In the event of a spill, OPL would be required to mitigate for damages to fish or fish habitats.

Operational Impacts - Columbia River Approach and Crossing Options. No operational impacts to fish would occur for any of the options approaching the Columbia River because no fish are present in this area of the pipeline corridor. There would be no impacts to fish from normal operation of the pipeline for any of the Columbia River crossing options. If product were to spill into the Columbia River, minor to major impacts to fish could occur, depending on the timing and the volume of the spill. Impacts would be similar to those described in the Columbia River spill scenario in the spill analysis section of the ASC and summarized discussions earlier in this section.

Cumulative Impacts. Cumulative impacts to fish are considered minor. Several salmon, trout, and steelhead stocks within the project area are federally listed or proposed for listing as threatened or endangered and/or considered depressed stocks by the WDFW. In areas where trenched crossings are proposed to cross spawning areas, the project could result in localized, short-term impacts to the quality and quantity of spawning habitat for these species. Many stream crossings during construction in the same watershed can reduce sediment from multiple sources. Due to planned low flow or no flow construction limited size of crossings and construction period, such release should be minor. Short-term loss of spawning habitat could locally reduce spawning success, but is not likely to significantly affect populations.

3.7.2.2 No Action

Under the No Action Alternative, the pipeline would not be constructed, and thus no construction or operational impacts of the proposed pipeline would result. Transport of product via

tanker trucks and river and ocean barges would increase to meet demand. This could increase the potential for impacts to fisheries if spills increased using those two transportation methods. Fishery resources from Seattle to the Kittitas area would be at risk from tanker trucks instead of a pipeline. Tanker truck spills are predicted to occur at a greater frequency but lower volume than a pipeline. A tanker truck or barge spill could have a similar impact to an isolated fish run or listed species as the proposal.

The frequency potential for spills related to transport under No Action is slightly greater than under the proposal, primarily due to the greater number of tanker truck trips and product being transported to and up the Columbia River and in Puget Sound and the coast. The significance of fisheries impacts could range from minor to major depending on the timing, volume, and location of an accidental spill.

3.7.3 Additional Proposed Mitigation Measures

3.7.3.1 Construction Mitigation and Subsequent Impacts

OPL has included BMPs to minimize impacts to fish and fish habitat associated with construction of stream crossings (Appendix C). Although it is not possible to completely eliminate all impacts, especially at invasive crossings, the following additional mitigation would further minimize impacts to fish:

- Complete a detailed analysis of alternative non-invasive crossing construction methods for sensitive stream crossings.
- Prepare site-specific construction plans for stream crossings with sensitive fish resources (including water quality).
- Complete the analysis of maximum scour potential for all stream reaches crossed by the pipeline.
- As mitigation for short-term degradation of bull trout spawning habitat, OPL could replace culverts at the Mill and Cold Creek crossings to increase the availability of spawning and rearing areas to the reintroduction of adfluvial bull trout to those streams. The existing culverts block fish passage from the lake into the stream above the John Wayne Trail, where most of the potentially available bull trout spawning habitat in these stream basins occurs. Replacement of these culverts would result in additional temporary turbidity and short-term sediment impacts to bull trout habitat downstream of the culverts. However, restoration of passage to habitat in the upper reaches of these streams, if reintroduction is successful, would result in a net beneficial impact to this species in the Keechelus Lake Basin.
- OPL has indicated they would replace culverts that are undersized, and that they may modify culverts that block migration of fish. To ensure that culverts are adequately

addressed, OPL should evaluate existing culverts and consult with agencies regarding requirements for culvert replacement during construction. Replacement of culverts would involve in-channel work that would increase the potential for sediment transport to streams, and could result in a short-term impact on fish habitat downstream of the culvert replacement. However, if the culvert replacement is successful in providing fish access to currently unutilized habitat, or prevents the failure of a culvert because it was in poor condition or undersized, the long-term impact of the replacement would be beneficial. BMPs and mitigation for culvert replacement are discussed in detail in Section 3.6, Water.

- Provide construction and post-construction monitoring to ensure BMP effectiveness.
- Provide downstream monitoring at all drill and bore crossings to minimize potential for drilling mud spill impacts.
- Even though no in-water work would occur at the Columbia River, perform the drilled crossing of the Columbia River during WDFW work windows to minimize the potential for impacts to salmonids from accidental spill of drilling muds.
- Provide downstream monitoring of turbidity at all invasive stream crossing sites.
- If blasting is required in or near streams that provide fish habitat, consult appropriate resource agencies and prepare a blasting plan that minimizes blasting needs and protects fisheries.
- Implement additional mitigation to protect water quality (see Section 3.6, Water).

3.7.3.2 Operational Mitigation and Subsequent Impacts

OPL has included numerous safeguards to minimize the potential for a product spill from the proposed pipeline. There is concern that channel scouring could expose the pipeline and subject it to damage, which could result in a product spill. OPL intends to place the pipe 0.6 m (2 feet) below maximum scour depth throughout the 100-year floodplain of each crossing to minimize the potential for the pipe to be exposed. However, determination of scour depth for many streams is difficult due to lack of suitable models. Regulatory agencies and OPL will determine suitable analytical and field methods to determine appropriate burial depths. Additional safeguards, such as monitoring scour at specific crossings, would be appropriate where high scour rates are possible (see Section 3.6, Water, for discussion of monitoring methods). If it is determined that the crossing is at risk (based on agency determined threshold values), corrective actions, up to and including cessation of pipeline operation, would be required.

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3.8 AIR QUALITY

3.8.1 Affected Environment

The affected environment for air quality includes the existing meteorology, climate, and pollution levels in the region of the proposed including its major elements. Air quality issues include emissions associated with construction of the pipeline and operational emissions associated with the pump stations and the Kittitas Terminal compared to relevant standards and regulations. These are discussed below.

3.8.1.1 Air Quality Standards

National Ambient Air Quality Standards (NAAQS) have been established by the U.S. Environmental Protection Agency (EPA) for a number of "criteria pollutants" including lead, ozone, carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), total suspended particulates (TSP), and particulates with aerodynamic diameters of less than 10 microns (PM10) (Table 3.8-1).

Several of these pollutants are subject to "primary" and "secondary" standards. Primary standards are designed to protect human health with a margin of safety. Secondary standards are established to protect the public welfare from any known or anticipated adverse effects associated with these pollutants such as soiling, corrosion, or damage to vegetation.

3.8.1.2 Prevention of Significant Deterioration

Prevention of Significant Deterioration (PSD) regulations were established by EPA to ensure that new or expanded sources of air pollution do not cause a deterioration in air quality in areas which currently meet ambient standards. The threshold for determining whether a facility is a major source and subject to PSD regulations is:

- a facility that falls within one of 28 listed categories and that emits more than 91 metric tons (100 tons) per year of any criteria pollutant, or

- a facility not listed that emits more than 227 metric tons (250 tons) per year of a criteria pollutant.

The first of these thresholds, a listed category, could apply to the proposal. However, the proposal does not meet or exceed the PSD threshold, as discussed in this section.

Table 3.8-1. National and State of Washington Ambient Air Quality Standards

Pollutant	National (EPA) *Primary*	National (EPA) *Secondary*	*Washington State*
Total Suspended Particulates			
Annual geometric mean	No standard	No standard	60 $\mu g/m^3$
24-hour average	No standard	No standard	150 $\mu g/m^3$
Lead (Pb)			
Quarterly average	1.5 $\mu g/m^3$	1.5 $\mu g/m^3$	1.5 $\mu g/m^3$
Particulate Matter (PM_{10})			
Annual arithmetic mean	50 $\mu g/m^3$	50 $\mu g/m^3$	50 $\mu g/m^3$
24-hour average	150 $\mu g/m^3$	150 $\mu g/m^3$	150 $\mu g/m^3$
Sulfur Dioxide (SO_2)			
Annual average	0.03 ppm	No standard	0.02 ppm
24-hour average	0.14 ppm	No standard	0.10 ppm
3-hour average	No standard	0.50 ppm	No standard
1-hour average	No standard	No standard	0.40 ppm[a]
Carbon Monoxide (CO)			
8-hour average	9 ppm	9 ppm	9 ppm
1-hour average	35 ppm	35 ppm	35 ppm
Ozone (O_3)			
1-hour average[b]	0.12 ppm	0.12 ppm	0.12 ppm
Nitrogen Dioxide (NO_2)			
Annual average	0.05 ppm	0.05 ppm	0.05 ppm

Note: Annual standards never to be exceeded. Short-term standards not to be exceeded more than once per year unless noted.

[a] 0.25 ppm not to be exceeded more than two times in 7 consecutive days.
[b] Not to be exceeded on more than 1 day per calendar year as determined under the conditions indicated in Chapter 173-475 WAC.

ppm = parts per million
PM_{10} = particles 10 or less microns in size
$\mu g/m^3$ = micrograms per cubic meter

Source: Washington Department of Ecology 1991.

3.8.1.3 Toxic Air Pollutant Regulations

The Washington Department of Ecology regulates emissions of known carcinogenic and toxic air pollutants from new and modified air pollution sources (WAC 173-460). EFSEC regulates those of qualifying energy facilities. The regulation establishes acceptable source impact levels (ASILs) for more than 500 substances.

For each known, probable, or potential human carcinogenic pollutant (the Class A toxic air pollutants), the ASIL limits the risk of an additional cancer case to one in a million. For others (the Class B toxic air pollutants), the ASIL is set by dividing those Class B toxics which have an inhalation reference factor by 300; this is intended to protect public health in communities with multiple sources of toxic air pollutants. Most of the Class A toxic air pollutant ASILs are based on an annual average concentration. A few of the Class A pollutants and all of the Class B pollutants are based on a 24-hour average concentration.

A facility can demonstrate compliance with WAC 173-460 by meeting established Small Quantity Emission Rates (SQERs) or by dispersion modeling. If a source which emits toxic air pollutants does not meet designated SQERs, a dispersion analysis is performed, comparing modeled ambient concentrations and the ASILs. If modeled concentrations are less than the ASILs, a permit can be granted. If not, the applicant must revise the project or submit a health risk assessment demonstrating that toxic emissions from the source are sufficiently low to protect human health.

3.8.1.4 Meteorology and Climate

This section describes the climatic regions in areas where the pipeline project would be located.

Puget Basin. The general climate of the Puget Basin is mild and moist, resulting from prevailing westerly winds off the Pacific Ocean to the west, and the shielding effect of the Cascade Mountains to the east. Winters are mild and summers are cool because of the steady influx of marine air.

Precipitation averages about 91 cm (36 inches) per year and approximately 127 cm (50 inches) per year at the foothills of the Cascades. Less than 20 percent of the annual rainfall occurs during the summer season (April through September). The average winter snowfall is about 23 cm (9 inches), but the snow seldom remains for more than 2 days.

West Cascades. The West Cascade region is influenced by terrain features and elevations which make generalization for this area difficult. Precipitation is very high on the western slopes and decreases along the eastern slopes. As a result of decreasing temperatures during the winter and combined elevation effects, most of the precipitation is in the form of snowfall. Annual snowfall accumulations may reach 1,524 cm (600 inches) with ground accumulations of 7.6 m (25 feet) or more. Temperatures average approximately 20°C (68°F) and may drop to below freezing at night. Precipitation during the summer averages about 8 percent of the annual total.

East Cascades. The East Cascades exhibit similar elevation trends as the West Cascades. Precipitation is not as heavy along the East Cascades, averaging 81 to 122 cm (32 to 48 inches) annually, with snowfall averaging about 508 cm (200 inches) per year. Mean temperatures for the region average -12°C (10°F) during January, and up to 27°C (80°F) in July.

Columbia Basin Hills. Topography in the Columbia Basin Hills includes a number of small valleys and ridges giving a local relief of as much as 305 m (1,000 feet). The climate of the Columbia Basin Hills is relatively mild and dry. This region has characteristics of both maritime and continental climates, modified by the Cascade and Rocky Mountains, respectively. Summers are dry and hot, and winters cool with only light snowfall. Afternoons are hot, but the dry air results in a rapid temperature fall after sunset, and nights are cool.

Precipitation follows the pattern of a West Coast marine climate with typical late fall and early winter highs. However, since the Columbia Basin Hills lie in the rainshadow of the Cascades, total precipitation is low. Snowfall in the Columbia Basin Hills area is light, averaging about 58 to 64 cm (23 to 25 inches). Winds are mostly light, averaging about 7 miles per hour for the year, being somewhat stronger in late spring and weaker in winter.

Columbia Basin Flats. The moderate climate of the Columbia Basin Flats is due to the prevailing flow of air from over the Pacific Ocean. Summer hot spells are caused by a northward drift of warm dry air. Most summers have about 4 days with temperatures of 38°C (100°F) or higher. Hot spells are broken by flows of cool air from over the ocean.

Annual precipitation in the Columbia Basin Flats usually ranges between 28 and 51 cm (11 to 20 inches). Precipitation is low because the prevailing flow of air from over the ocean loses much of its moisture while crossing the Cascade Mountains. Terrain effects on most elements of local weather are frequently greater than those associated with migratory weather systems. Winds are generally quite light but occasional wind storms and dust storms may be expected.

3.8.1.5 Existing Air Quality

The Kittitas Terminal would be the largest source of pollutants associated with the proposal. The Kittitas Terminal would be located in an unclassified area for all established criteria pollutants. Pump stations would be minor sources of air pollutants. Portions of the pipeline would be located in King and Snohomish Counties, which have recently been reclassified as attainment areas for ozone, CO, and PM10.

The Washington Department of Ecology maintains a network of monitoring stations throughout the state. Monitoring stations are located mainly in urban areas where pollutant concentrations are expected to be higher, either adjacent to major sources of pollutants or near potential problem areas. There are no monitoring stations for criteria pollutants in the vicinity of the Kittitas Terminal because the area does not experience significant air quality problems.

3.8.2 Environmental Consequences

3.8.2.1 Proposed Petroleum Product Pipeline

Construction Impacts

Pipeline. Emissions associated with pipeline construction would include vehicle exhaust from a number of activities such as preparing the corridor, installing pipe and backfilling the trench, and fugitive dust generated by earthmoving activities and vehicles traveling on unpaved surfaces. Air quality impacts associated with these activities would be localized and temporary, lasting only for the duration of the construction period until exposed soils are stabilized.

Construction equipment exhaust emissions would be well below levels that would cause long-term exceedances of the air quality standards for CO, SO_2, and nitrogen oxides, and would occur for only a short time at any one location. The only construction activities that could generate substantial emissions would be those producing fugitive dust.

OPL conducted dispersion modeling using the ISCST3 model to determine the maximum concentrations of fugitive dust (TSP and PM10) that could be generated by construction of the pipeline. Based on modeling results detailed in the ASC (OPL 1998), it is possible that TSP and PM10 levels could exceed the 24-hour standard within approximately 100 m (328 feet) of the pipeline while site preparation and pipelaying activities are in progress. However, the short duration and localized nature of construction activities at any particular location would minimize overall impacts. Measures to control fugitive dust during construction of the pipeline and pump stations will consist of watering the ROW periodically, as necessary; applying gravel to access roads where traffic volumes are high and where the road surface will need improvement; curtailing construction activities when high winds are contributing to excess dust; and limiting onsite construction speeds to 10 miles per hour.

Pump Stations. No specific information is available on emissions associated with construction of the pump stations. However, due to the small sites required for each pump station, ranging from 0.4 ha (1.0 acre) to less than 1.6 ha (4 acres) per site, site disturbance during construction of the pump stations would not generate substantial emissions from either construction vehicles or fugitive dust.

Kittitas Terminal. Fugitive dust emissions associated with construction of the Kittitas Terminal were estimated using emission factor equations for heavy-duty construction activities from EPA's Compilation of Air Pollutant Emission Factors (AP-42). Emission factor equations relate the quantity (weight) of pollutants emitted to a unit of activity of the source. AP-42 equations are used to estimate area-wide emissions, emissions from a specific source, and evaluation of emissions relative to ambient air quality.

Assuming that the entire site (10.9 ha or 27 acres) is disturbed for one full month of construction, approximately 29.5 metric tons (32.4 tons) of PM10 would be generated during the construction period. Uncontrolled emissions could be reduced by water suppression methods, which

can yield a 50 percent decrease in fugitive emissions, reducing overall fugitive dust emissions to approximately 14.8 metric tons (16.2 tons). These emissions would be considered negligible for this project. Existing tilling activities at the site may produce similar emissions.

Operational Impacts

Pump Stations. Operation of the Thrasher, North Bend, Stampede, Beverly-Burke, Othello Pump Stations, and the Pasco Delivery Facility would not produce major emissions because all equipment at these stations would be operated electrically. Leaks from equipment (e.g., seals, flanges, and connections) would be a potential source of fugitive volatile organic compound (VOC) emissions.

All of the pump stations would have a similar design, with the exception of the Thrasher Station which would require additional valves, pipeline hardware, and connections because it ties into an existing pipeline. VOC emissions from the pump stations and the Pasco Delivery Facility were estimated using emission factor equations from AP-42. Each of the pump stations would emit approximately 0.49 metric ton (0.54 ton) per year of VOCs, and would be considered a negligible source of VOC emissions (OPL 1998). The pump stations would not require registration with the state because of the negligible emissions.

Kittitas Terminal. The terminal would be the largest source of emissions associated with the proposal. Because of the nature of the operations at the terminal (storage and loading of fuels), total VOCs would be the primary pollutant of concern. Toxic emissions (benzene) were also estimated and compared to Ecology's ASILs. Pumping and metering equipment at the Kittitas Terminal would be operated by electricity; therefore, emissions associated with this equipment would be negligible.

The Kittitas Terminal would include a diesel-operated firewater pump for use during emergency situations. This pump would be periodically tested to ensure proper operation. The firewater pump would be operated one-half hour per week as required by fire safety codes. The pump uses a diesel-operated internal combustion engine rated at 200 horsepower. AP-42 emission factor equations were used to estimate potential emissions from this source. Because the pump would be operational for only 26 hours per year, emissions from this source would be much less than 0.9 metric ton (1 ton) per year for all criteria pollutants, and would be considered negligible. (OPL 1998.)

Thus, the primary sources of operational emissions from the Kittitas Terminal include: (1) bulk storage tanks; (2) dispensing of fuel from storage tanks to tanker trucks (truck loading losses); and (3) fugitive emissions from pipeline valves, flanges, and pump seals throughout the facility. These are discussed in detail below.

Total VOC emissions for the Kittitas Terminal from storage tanks (12.9 metric tons [14.22 tons] per year) and all other sources are estimated at 14.09 metric tons (15.54 tons) per year. This is less than the threshold of 91 metric tons (100 tons) which defines a major source (WAC 173-44-030).

Bulk Storage Tanks. The design of storage tanks at the Kittitas Terminal would be determined from the types of products in demand and the quantity of demand for those products. For this analysis, demand was based on historical records and OPL's professional experience and judgement about what types of products would likely be stored at the facility.

The fuel types (and percentage of total volume) to be transported and stored at the terminal were assumed to be subgrade gasoline (20.1 percent), regular gasoline (20.1 percent), premium gasoline (19.8 percent), low-sulfur diesel (18 percent), and high-sulfur diesel (22 percent). Each storage tank would operate on a 6-day turnover cycle which would result in a maximum of 60 turnovers per year for each tank. OPL has indicated that they would accept permit restrictions limiting throughput of fuel into the storage facility at 39,639,000 bbls per year (approximately 100,000 bbls per day). (This is equivalent to about 1.6 billion gallons per year, assuming 42 gallons per barrel.)

Storage tanks containing volatile liquids such as petroleum products have product losses during storage due to evaporation of the liquid (standing losses) and losses as a result of changes in liquid levels (working losses). Standing losses in tanks with internal floating roofs occur mainly as a result of an improper fit between the deck seal and the wall of the tank. These seals slide against the tank wall as the deck is raised or lowered. Other penetrations in the deck, such as gauge attachments, access hatches, ladder wells, and column wells, also contribute to standing losses. Standing losses can be minimized through the use of primary and secondary deck seals, and inspection of the storage tank equipment, all of which are required by regulation (40 CFR Part 60, Subpart Kb).

Working losses result from residual liquid on the tank wall or support columns during lowering of the liquid levels. The design of an internal floating roof with an external fixed roof reduces evaporative emissions due to wind loss.

An EPA model, TANKS3, was used to estimate VOC storage tank losses. Input parameters and assumptions used in the program are included in the ASC (OPL 1998). Approximately 12.9 metric tons (14.22 tons) per year of total VOC emissions would result from storage tank losses at the Kittitas Terminal and would be considered a minor impact.

Loading Rack. OPL is seeking to limit daily throughput out of the terminal to central Washington markets at 1,020,000 gallons per day. Annual throughput would be 373,300,000 gallons per year. The remaining product would continue in the pipeline to Pasco.

Two tanker trucks with a carrying capacity of 10,000 gallons can load product simultaneously, taking approximately 20 minutes per loading operation. Therefore, the maximum number of trucks that could load product is six trucks per hour. The loading rack is anticipated to operate 24 hours per day with the majority of the loading occurring during the early morning and daylight hours. This would be equivalent to 102 trucks with 10,000-gallon capacity loading product in a 24-hour period.

The proposed design of the truck rack includes a vapor recovery system with a high-efficiency carbon adsorption system to reduce emissions of VOCs by at least 99.9 percent. This level of emission control more than satisfies the requirement to limit emissions to no more than 10 milligrams

per liter (mg/l) of gasoline loaded, which is stipulated by the maximum achievable control technology (MACT) standard for this source category (40 CFR 63 Subpart R). The calculated emission rate for the facility at this level of control is approximately 1 mg/l. Vapor recovery and carbon adsorption with a 99.9 percent level of VOC control is considered to be the "top" level of emission control available for this equipment.

Dispensing fuel from the storage tank into tanker trucks at the main loading rack could result in the loss of VOCs at many locations. Tanker truck loading at the Kittitas Terminal would be by bottom-filled, submerged loading with dry coupling attachments at the product-loading arms. With this method of loading, the tanker truck is filled from the bottom of the tanker with the loading arm submerged below the liquid level. Dry-break couplings on the loading arms virtually eliminate product spills and vapor emissions when decoupling the arms from the trucks. The vapor recovery system consists of a vapor recovery unit and processing of displaced vapors from the truck tank. This method of loading is considered the most effective means of reducing VOC losses during loading.

VOC losses due to tank truck loading were estimated using AP-42 emission factor equations provided by the EPA (1995) for this type of operation (emission factor equation and assumptions concerning loading losses are detailed in OPL 1998). The use of a 99.9 percent efficient vapor recovery system would reduce uncontrolled, total VOC losses at the loading rack from a potential 823 metric tons (907 tons) per year to less than 0.91 metric ton (1 ton) per year. This would be a minor impact.

Fugitive VOC Emissions. Fugitive emissions of VOCs could result from leaking valves, flanges, compressor seals, and other components throughout the terminal. The most feasible control option is an inspection and maintenance program to identify and repair leaking components on a routine basis. To meet the benzene ASIL, zero-emissions valves and pump seals would be used as part of the vapor recovery system. Zero-emissions equipment is the most effective means for controlling fugitive emission VOCs and benzene emissions.

Fugitive emissions resulting from leaks in the pipeline valves, flanges, and pump seals were estimated using AP-42 emission factor equations and guidance provided by EPA (1996). Total VOC emissions due to leaks are estimated at 0.37 metric ton (0.41 ton) per year (uncontrolled). With proper monitoring of the facility and reporting of leaks as required by 40 CFR Part 63, OPL estimates that controlled fugitive emissions could be reduced to approximately 0.22 metric ton (0.24 ton) per year. (OPL 1998.)

Fugitive Dust. Annual PM_{10} emissions from the site are likely to be reduced because of elimination of current farming practices and conversion of exposed soil to impervious surface.

Toxic Pollutants. Emissions of toxic pollutants must comply with requirements established by Ecology in WAC 173-460. Compliance with ASILs for a toxic pollutant can be demonstrated by either (1) meeting Small Quantity Emission Rates (SQERs) for each toxic pollutant emitted, or (2) using air dispersion modeling to demonstrate that concentrations of toxic air pollutants do not exceed the ASIL for that pollutant.

OPL estimates that benzene emissions from the Kittitas Terminal operations would equal approximately 164 kilograms (362 pounds) per year, exceeding the SQER of 9 kilograms (20 pounds) per year. Therefore, dispersion modeling was performed to demonstrate compliance with the benzene ASIL (0.12 micrograms per cubic meter).

Toxic pollutant modeling for benzene concentrations at and beyond the property boundary was performed using ISCLT3, an EPA-approved, long-term dispersion model. All pollutant-emitting sources at the facility were considered in the modeling, including storage tanks emitting benzene, fugitive benzene emissions, and benzene emissions from the vapor recovery system. Results from the modeling indicate that the maximum benzene concentration of 0.1 microgram per cubic meter occurs along the west border of the property. This would meet the designated benzene ASIL of 0.12 microgram per cubic meter.

Odor. The primary source of odor at the Kittitas Terminal would be petroleum. Emission control technologies employed on the tanks and loading operations would minimize fugitive emissions of VOCs and the release of odors into the surrounding area.

To evaluate potential odor impacts, the ISCST3 computer model was run with emissions from all sources at the Kittitas gasoline distribution facility and the full set of meteorological inputs from the SCREEN3 model used to estimate the maximum 1-hour VOC concentration that would occur due to operations of the proposed facility (refer to the ASC for details concerning the modeling parameters). The highest 1-hour VOC concentration was estimated at 126.43 micrograms per cubic meter at a receptor near the western fence line of the facility. The maximum 1-hour VOC concentration was used as the basis for an evaluation of the maximum potential for offsite odor impacts as discussed below.

First, the predicted VOC concentration was multiplied by an assumed peak-to-mean ratio of 2.0 to account for the fact that odor detection occurs on a time scale smaller than 1 hour. This factor corresponds roughly to the use of the power law relationship in Turner (1969) for scaling from a 1-hour average concentration to a maximum 1-minute concentration, which is a more suitable basis for evaluating odor effects.

Next, the assumed maximum 1-minute concentration of VOC was apportioned according to the mass fractions of constituent compounds in gasoline vapors, since these vapors would be the dominant source of VOC emissions at the proposed facility. The gasoline compound with the highest odor potential is toluene. The published odor threshold for toluene is 2.9 parts per million (Amoore and Hautala 1983). The fraction of toluene in the maximum predicted 1-minute concentration at the fence line is estimated at 0.0004 parts per million, which is several orders of magnitude below the odor detection threshold for this compound. Based on this result, the concentrations of other compounds with lesser odor potentials would be far below their respective detection limits. (OPL 1998.)

Clarkston and Umatilla Oil Terminals. The product terminals at Umatilla and Clarkston are likely to close with the project because Tidewater Barge Lines, Inc., would no longer haul product up the Columbia River. If closed, VOC emissions from these tank farm terminals would be eliminated.

Columbia River Approach and Crossing Options. There are no differences in air quality impacts from either the Ginkgo State Park/YTC segment options or the Columbia River crossing options.

Cumulative Impacts. No significant air emissions are expected from the project and no other significant hydrocarbon source in the area is known. The proposed project would contribute minor air emissions in the region. No cumulative emissions impacts would occur.

3.8.2.2 No Action

Under the No Action Alternative, the proposed pipeline would not be constructed; current modes of product transport would continue and would increase in volume over the years. Additional truck traffic would be required to distribute product to eastern Washington markets.

According to OPL, truck traffic on major roadways would increase from 50 to 60 tanker trucks per day under existing conditions, to 128 trucks per day in 2026. Given the existing traffic volumes on I-5 and I-90 (10,000 to 30,000 vehicles per day depending on location), this increase in truck volumes would have a negligible impact on air quality.

Barge traffic would continue to increase on the Columbia River and operation of the oil product terminals at Portland would continue with or without the project. Compared to traffic volumes on I-84 adjacent to the Columbia River (average daily traffic volumes of approximately 27,000 vehicles per day), barge emissions on the Columbia River are negligible. Assuming three petroleum-related barge trips through the Columbia River Gorge (approximately 120 km [75 miles]) per week, monthly emissions would be less than 2 metric tons each of CO, hydrocarbons (HC), and NO_x. Traffic emissions on I-84 through the same 75-mile stretch would be approximately 910 metric tons (1,000 tons) of CO, 97 metric tons (107 tons) of HC, and 237 metric tons (260 tons) of NO_x. Therefore, increasing or decreasing barge traffic on the Columbia River would have a negligible impact on overall air quality.

In addition, VOC emissions would continue as a result of barging operations on the Columbia River including emissions from the Clarkston and Umatilla terminals. According to OPL, more than 410 metric tons (450 tons) per year of VOCs are emitted each year as a result of barge loading on the Columbia River. This would likely increase as a result of more barge operations in the future.

The Kittitas Terminal site would continue as farmland with associated harvest, planting, and soil exposure releasing fugitive dust.

3.8.3 Additional Proposed Mitigation Measures

3.8.3.1 Construction Mitigation and Subsequent Impacts

There are no mitigation measures proposed for construction of the pipeline beyond those proposed by OPL in the ASC.

3.8.3.2 Operational Mitigation and Subsequent Impacts

There are no mitigation measures proposed for the Kittitas Terminal or for the pipeline and pump stations beyond those required by regulation.

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3.9 NOISE

3.9.1 Affected Environment

Noise regulations (state, county, and local) specify standards that restrict both the level and duration of noise measured at any given point within a receiving property. The maximum permissible environmental noise levels depend on the land use of the property that contains the noise source (e.g., industrial, commercial, or residential) and the land use of the property receiving that noise. Noise standards applicable to this proposal are shown in Table 3.9-1. Sound levels associated with typical sources of noise are shown in Table 3.9-2. Potential noise sources from this project include construction noise, noise associated with the pump stations, noise at the Kittitas Terminal, and aerial flyovers of the alignment every 1 to 2 weeks.

Table 3.9-1. Maximum Permissible Environmental Noise Levels (dBA) Ecology and King/Snohomish County Combined

	EDNA of Receiving Property[b] Day (7 a.m. - 10 p.m.)			
EDNA[a] of Noise Source	Rural	Class A Residential	Class B Commercial	Class C Industrial
Rural	49	52	55	57
Class A Residential	52	55	57	60
Class B Commercial	55	57	60	65
Class C Industrial	57	60	65	70

[a] EDNA = Environmental designation for noise abatement.

[b] Class A = Residential areas of lands where human beings reside and sleep; such as residential areas, multiple family living areas, recreational and entertainment areas (campgrounds, parks, resorts), community service areas (retirement homes, hospitals, health and correctional facilities).

Class B = Commercial areas or land uses requiring protection against noise, interference with speech; such as commercial living and dining areas, motor vehicle services, retail services, banks, office buildings, and recreational areas not used for habitation (theaters, stadiums, fairgrounds, amusement parks).

Class C = Industrial areas or lands involving economic activities; such as agricultural, storage, warehouse, production, and distribution facilities.

Rural = Rural areas with King County zoning districts designated as A, F-r, E-P, S-E, G, and S-R greater than 35,000 square feet.

Maximum permissible levels during normal sleeping hours (10 p.m. to 7 a.m.) are further reduced by 10 dBA at Class A EDNAs.

Table 3.9-2. Weighted Sound Levels and Human Response

Sound Source	dBA[a]	Response
Carrier deck jet operation	140	
Limit of amplified speech	130	Painfully loud
Jet takeoff (200 feet) Auto horn (3 feet)	120	Threshold of feeling and pain
Riveting machine Jet takeoff (2,000 feet)	110	
Shout (6 inches) New York subway	100	Very annoying
Heavy truck (50 feet) Pneumatic drill (50 feet)	90	Hearing damage (8 hour exposure)
Freight train (50 feet) Garbage disposal in home	80	Annoying
Freeway traffic (50 feet)	70	Telephone use difficult
Air conditioning unit (20 feet) Light auto traffic	60	
Speech in normal voice (15 feet)	50	Quiet
In-house movement of people, no TV or radio	40	
Soft whisper (15 feet)	30	Very quiet
Recording studio	20	
	10	Very faint
	0	Threshold of hearing

[a] Typical A-weighted sound levels. The "A" scale approximates the frequency response of the human ear.

Source: U.S. Council on Environmental Quality 1970.

3.9.1.1 Existing Sound Levels at Pump Station Sites

Noise monitoring was conducted by OPL in August and September 1995, and additional monitoring in August 1996, to characterize existing noise conditions in the vicinity of each station (Thrasher, North Bend, Stampede, Kittitas, Beverly-Burke, and Othello). At each pump station site, monitoring locations were chosen which represented the most sensitive land uses in the vicinity of the proposed station. (OPL 1998.)

The Thrasher Station would be located on 46th Avenue near the existing OPL Woodinville Station. Land uses surrounding this site are primarily rural residential. At the Thrasher Station, measured sound levels ranged from 45 A-weighted decibels or dBA (night) to 74 dBA (day). At times the daytime sound levels exceeded the applicable noise standards due to nearby vehicle traffic and other sources of background noise (e.g., aircraft overflights).

The North Bend Station would be located south of SE 120th Street and south of the Cedar Falls Trail (at one time it was proposed for north of the trail). Land uses surrounding this site are primarily urban and rural residential. Measured sound levels ranged from 42 dBA (night) to 49 dBA (day). The nighttime standard was exceeded at several locations during the evening period.

The Stampede Pass Station would be constructed at a later date and only if needed. This station would be located near Stampede Pass Road, east of Lake Easton. Measured sound levels ranged from 44 dBA (night) to 66 dBA (day). The nighttime standard was exceeded at one location due to background traffic noise and other extraneous noise sources.

The Kittitas Station would be located at the proposed Kittitas Terminal on agricultural land at I-90/Badger Pocket Road. Existing sound levels in the vicinity of the Kittitas Station and Terminal ranged from 49 dBA (night) to 66 dBA (day). The existing noise environment was dominated by traffic noise from I-90 and noise from agricultural activities.

The Beverly-Burke and Othello Stations would be constructed at a later date if needed. The Beverly-Burke Station would be located in Grant County about 6.4 km (4 miles) east of the Columbia River in uncultivated rangeland. The Othello Station would be located approximately 9.7 km (6 miles) southwest of Othello near Highway 24 on agricultural land. Measured sound levels at both stations ranged from 40 dBA to 50 dBA. There were no exceedances of either the day or nighttime noise standard at either location.

3.9.1.2 Existing Sound Levels at Kittitas Terminal

The Kittitas Terminal (which would most likely be classified as an industrial noise source) would be constructed near the existing I-90 interchange, approximately 1.6 km (1 mile) south of Kittitas. There are two gas stations/convenience stores near the interchange. The area is generally surrounded by agricultural land. There are no permanent residences or other sensitive noise receptors immediately adjacent to the site.

Noise monitoring was conducted by OPL at five locations in the vicinity of the proposed Kittitas Terminal in September 1995 to characterize existing noise conditions. As noted above, existing noise levels in the vicinity of the Kittitas Terminal ranged from 49 dBA (night) to 66 dBA (day) and were dominated by traffic noise from I-90. (OPL 1998.)

3.9.2 Environmental Consequences

3.9.2.1 Proposed Petroleum Product Pipeline

Construction Impacts. Construction noise would occur over short time periods during limited hours along the alignment. The Kittitas Terminal is the largest single project facility and the potential source of the greatest amount of construction noise.

Short-term impacts due to construction activities would be expected along the pipeline corridor and at the pump stations. Primary noise impacts would be associated with earth-moving equipment and other construction activities. Conventional construction equipment, including bulldozers, graders, scrapers, and heavy-duty trucks and cranes, would be used at these sites. Construction impacts would be temporary, lasting only for the duration of the construction period. For a discussion of noise impacts on wildlife, see Section 3.5, Wildlife.

Most noise standards exempt construction noise between the hours of 7 a.m. and 10 p.m. According to OPL, no nighttime construction activities would be required. As a result, the noise impacts due to construction would be negligible.

Operation Impacts. Major noise sources associated with operation would include the Kittitas Terminal and the six pump stations. According to OPL, three pump stations would be built initially (Thrasher Station, North Bend Station, and Kittitas Station) and two (Thrasher Station and North Bend Station) would be fully enclosed to reduce noise and provide protection from the elements. Most of the pump stations and the Kittitas Terminal are located in relatively isolated and unpopulated areas without nearby residential receptors. The Kittitas Terminal is the largest single project facility and the potential source of the greatest amount of operational noise.

Pump Stations. The Thrasher Station would be an enclosed facility. According to Owens' Corning guidance for sound transmission loss, the enclosure would reduce noise transmission by 40 dBA. Operation of the Thrasher Station would not increase existing noise levels at nearby receptors during the day or evening periods. The noise impact due to pump station operation at this location would be negligible.

The North Bend Station would also be enclosed to reduce sound transmission. The enclosed pump station at this location would not cause an increase in noise levels at nearby receptors and would have a negligible impact.

The Stampede Pass Station would not be among the first pump stations constructed. At the Stampede Pass Campground (near the pump station site), traffic noise from I-90 is audible. Operation of the pump station at this location would not increase overall noise levels in the area.

The Beverly-Burke Station would not be enclosed. The estimated noise level for the proposed pump station would be 80 dBA at a distance of 4.6 m (15 feet) from the source. At a distance of 18.3 m (60 feet) from the pump station, the noise criteria would be met. (OPL 1998.) There are no

residential receptors within miles of the pump station; therefore, there would be no noise impacts. The site is in a remote agricultural area.

Similar to the Beverly-Burke Station, the noise generated by the Othello Station would not impact the nearest residence due to the noise attenuation over a very large distance in this remote agricultural area.

Noise impacts associated with the Pasco Delivery Facility would be similar to the other pump stations. Because the equipment associated with the Delivery Station would be enclosed, noise impacts associated with its operation would be minimal.

Kittitas Terminal. The predominant noise source would be at the Kittitas Terminal. Noise sources would include increased truck traffic to and from the terminal, noise from the truck loading rack, and noise from the pumps delivering product from storage tanks to the loading rack. The nearest commercial receptors to the terminal are the Texaco and BP gas stations, south and west of the proposed terminal, respectively. The nearest residential receptors are approximately 0.8 km (0.5 mile) south and east of the terminal. Operational impacts associated with the Kittitas Terminal were estimated by adding noise generated due to operation of the terminal to the existing ambient noise levels at each receptor in the vicinity of the site.

Loading Rack Operations. To estimate noise impacts associated with the loading rack operation, noise monitoring was performed at a similar facility in Renton, Washington (OPL 1998). During the truck loading cycle at the Renton facility, one truck produced a sound level of 81 dBA at a distance of 9.1 m (30 feet) from the noise source. According to OPL, the loading rack at the proposed terminal would be able to accommodate two trucks loading product simultaneously. If one truck loading operation produced a noise level of 81 dBA, then two simultaneous loading operations would create a noise level of 84 dBA at 9.1 m (30 feet) from the center of the noise source, based on logarithmic addition of the two noise sources.

The loading rack operation would increase existing sound levels by approximately 2 dBA at the Texaco station west of the terminal. An increase of 2 dBA would be imperceptible to the average individual (in general, sound level increases of 3 to 5 dBA are generally noticeable to most people). At the nearest residential receptors, sound level increases would be less than 1 dBA and would be negligible.

Kittitas Pump Station Operations. In addition to truck loading operations, noise impacts would also result from operation of the pump station at the Kittitas Terminal. Impacts associated with pump station operations were estimated based on noise data collected from an existing pump station in Renton (OPL 1998). The hourly equivalent constant sound level or Leq recorded at the existing pump station in Renton was 80 dBA.

Noise level increases due to operation of the pump station would be less than 2 dBA at all receptor locations, which is a negligible impact.

Combined Noise Impacts at the Kittitas Terminal. If the loading rack and the pump station operated simultaneously, a combined noise level would be generated. The pump

station would operate 24 hours per day, while the loading rack may operate intermittently throughout the same period. To assess a worst-case scenario, it was assumed that both sources would be operating simultaneously. At all receptor locations, the combined noise impact from simultaneous operation of the pump station and the loading rack would be less than 3 dBA and would be a negligible impact.

Aerial Overflights. OPL would perform fixed-wing airplane aerial surveillance at altitudes averaging 305 m (1,000 feet) above ground level over the pipeline corridor to visually inspect the alignment at least once every 2 weeks. The noise generated during these inspections could be an annoyance to residents, hikers, or campers in the vicinity of the pipeline corridor. Duration of the noise from the overflight would be less than a minute at any location. Helicopters are not proposed to be used.

Columbia River Approach and Crossing Options. Noise impacts would be the same for all Columbia River crossing options, most of which cannot be seen by air. YTC crossing options that use or come close to Ginkgo Petrified Forest State Park would have greater, though infrequent, noise impacts due to aerial flyovers.

Cumulative Impacts. Noise emissions from pump stations and the Kittitas Terminal would be minor and not in the vicinity of other noise sources. No cumulative impacts would occur.

3.9.2.2 No Action

Under the No Action Alternative, the proposal would not be constructed; current modes of product transport would continue and would increase in volume. Additional truck traffic would be required to distribute product to eastern Washington markets. According to OPL, truck traffic on major roadways would increase from 50 to 60 tanker trucks per day now, to 128 trucks per day in 2026. Given the existing traffic volumes on I-5 and I-90 (10,000 to 30,000 vehicles per day depending on location), this increase in truck volumes would have a negligible impact on noise.

3.9.3 Additional Proposed Mitigation Measures

None are proposed.

3.10 TRAFFIC AND TRANSPORTATION

3.10.1 Affected Environment

3.10.1.1 Highways and Roads

Figure 3.10-1 shows the major state highways and interstates in the vicinity of the proposed pipeline corridor. The proposed pipeline would cross or lie adjacent to approximately 120 roadways, ranging from major interstates to two-lane county roads and USFS roads.

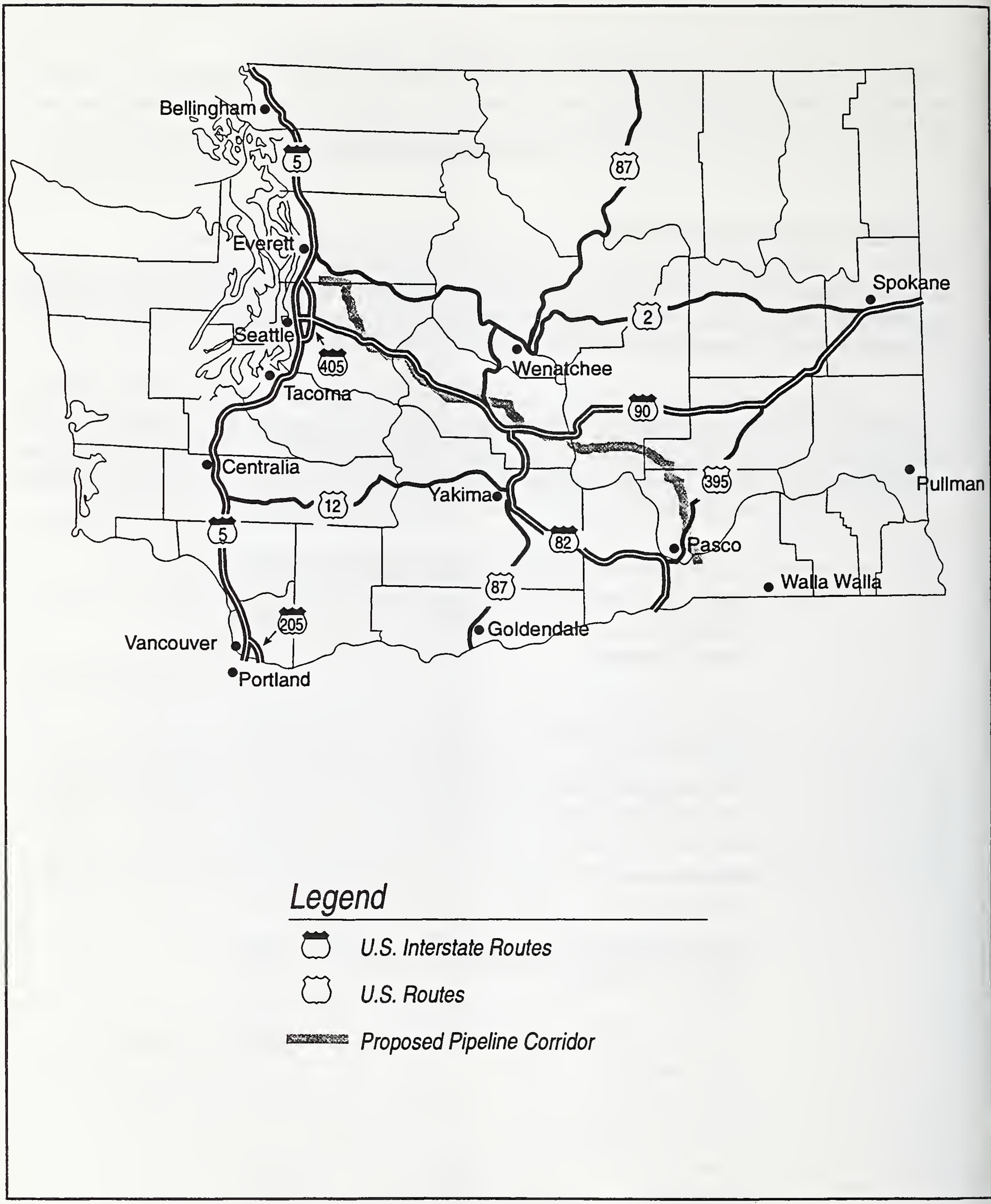
Approximately 176.2 km (109 miles) or 47 percent of the approximate 370 km (230-mile) pipeline corridor would be within existing ROW. About three-quarters of the ROW is in private ownership. Most of the ROW in agency ownership belongs to the USFS (18 km [11 miles]), Bureau of Reclamation (19 km [12 miles]), Washington State Parks and Recreation (32 km [20 miles]), and the Washington State Department of Natural Resources (13 km [8 miles]) (Table 3.10-1).

Table 3.10-1. Summary of Right-of-Way Ownerships

Ownership	Miles*	Percentage
Federal Agencies:		
U.S. Forest Service	11.34	4.9
Bureau of Land Management	0.54	0.2
Bureau of Reclamation	12.42	5.4
U.S. Fish & Wildlife Service National Wildlife Refuge	0.45	0.2
Total Federal Ownership	24.75	10.7
State Agencies:		
Natural Resources	7.55	3.3
Parks & Recreation	19.76	8.6
Department of Fish and Wildlife	0.22	0.1
Total State Ownership	29.73	12.9
Local Agencies:		
King County Roads	1.51	0.7
Private Ownership:		
Private Owners	175.04	75.9
Total Miles	230.70	100

Source: OPL 1998.

* Numbers are approximate and not the result of boundary survey.



ROADS IN THE PROJECT VICINITY

Cross Cascade Pipeline
Washington
FIGURE 3.10-1

Under existing conditions, OPL estimates that approximately 50 to 60 tanker trucks per day cross the Cascade Mountains via I-90 or U.S. Highway 2, transporting gasoline products from the Seattle-Tacoma area to central Washington that cannot be carried by pipeline. Depending on location, the average daily traffic (ADT) volumes on U.S. Highway 2 and I-90 range from approximately 5,000 to more than 28,000 vehicles per day. The existing tanker truck traffic using the two major state highways represents a very small component of the overall traffic volumes on these highways.

Part of the rationale for this project is the effect of traffic delays on the passes and their effect on product delivery. WSDOT was contacted (Myhr pers. comm.) to get a sample of traffic delay data on one pass. Over a 4-month period, November 1996 through March 1997, there were 100 closures of all or part of I-90 between Seattle and Ellensburg. Approximately half were eastbound. There were 30 total closures of I-90, eastbound and westbound over the 1996-97 winter season and half that many in 1995-96. There were 6 closures exceeding 12 hours in duration in 1996-97, all of which closed both lanes for periods ranging from 20 to 40 to 80 hours. Delays were so significant that an escorted convoy of fuel trucks was driven over Snoqualmie Pass.

Roads potentially affected by the project generally operate at level of service (LOS) B or better, or have very low ADT volumes (generally less than 500 vehicles per day). The exceptions are State Route 9 and State Route 522 (both north of State Route 524), which operate at LOS D. (OPL 1998.) The principal east-west corridor from Seattle to Kittitas is I-90.

3.10.1.2 River Transport and Barging

According to OPL, under existing conditions, three barges per week are used to transport petroleum products up the Columbia River from Portland, Oregon to Pasco, Washington. Tidewater Barge Company is the sole operator of refined petroleum product being transported from Portland to terminals in Pasco, Clarkston, and Umatilla.

3.10.1.3 Marine Barging Activities

Currently each of the four northwest refineries ships product via tanker and barge on Puget Sound to meet demand that is not met due to the lack of capacity of the Olympic pipeline. One refinery indicated that they shipped nearly 990,000 bbls of product to Portland in 1996 and an additional 535,000 bbls to Harbor Island (Stanley pers. comm.).This was shipped in a combination of tankers and barges but included 31 shipments to Portland and 27 shipments to Harbor Island, or about 5 shipments a month at an average of 25,000 bbls per shipment. Another refinery contacted for this analysis stated that they carried more than that but would not release actual numbers. Assuming that the two refineries that were not contacted shipped similar amounts, at least a dozen and perhaps as many as 20 petroleum barge shipments a month (at 25,000 bbls per shipment) are sent on to Puget Sound by the northwest refineries as a result of lack of capacity of the existing line.

3.10.1.4 Railroads

The Burlington Northern Railroad runs from Everett through the Cascade Mountains to Spokane. From Spokane, the Union Pacific Railroad travels south through Hooper Junction (near Washtucna, Washington) to Kennewick. A line also extends from Auburn through Stampede Pass to Cle Elum where it meets the Washington Central Railroad Company. The Washington Central Railroad Company runs east to Kennewick. (See Figure 3.10-2 for railroad route overview.)

3.10.1.5 Air Transportation

Because of the lack of capacity of the existing OPL pipeline system, OPL has had to place restrictions on its existing pipeline system by prorating capacity among shippers. The ability to serve the airlines at Sea-Tac and Portland International Airports has been affected. The existing OPL pipeline is the only means for transporting jet fuel to the Sea-Tac International Airport. Air travel is anticipated to continue to increase (as evidenced by the need for a third runway at Sea-Tac International Airport). Proration increases costs for airlines in all cities because product must be acquired via more expensive means.

3.10.2 Environmental Consequences

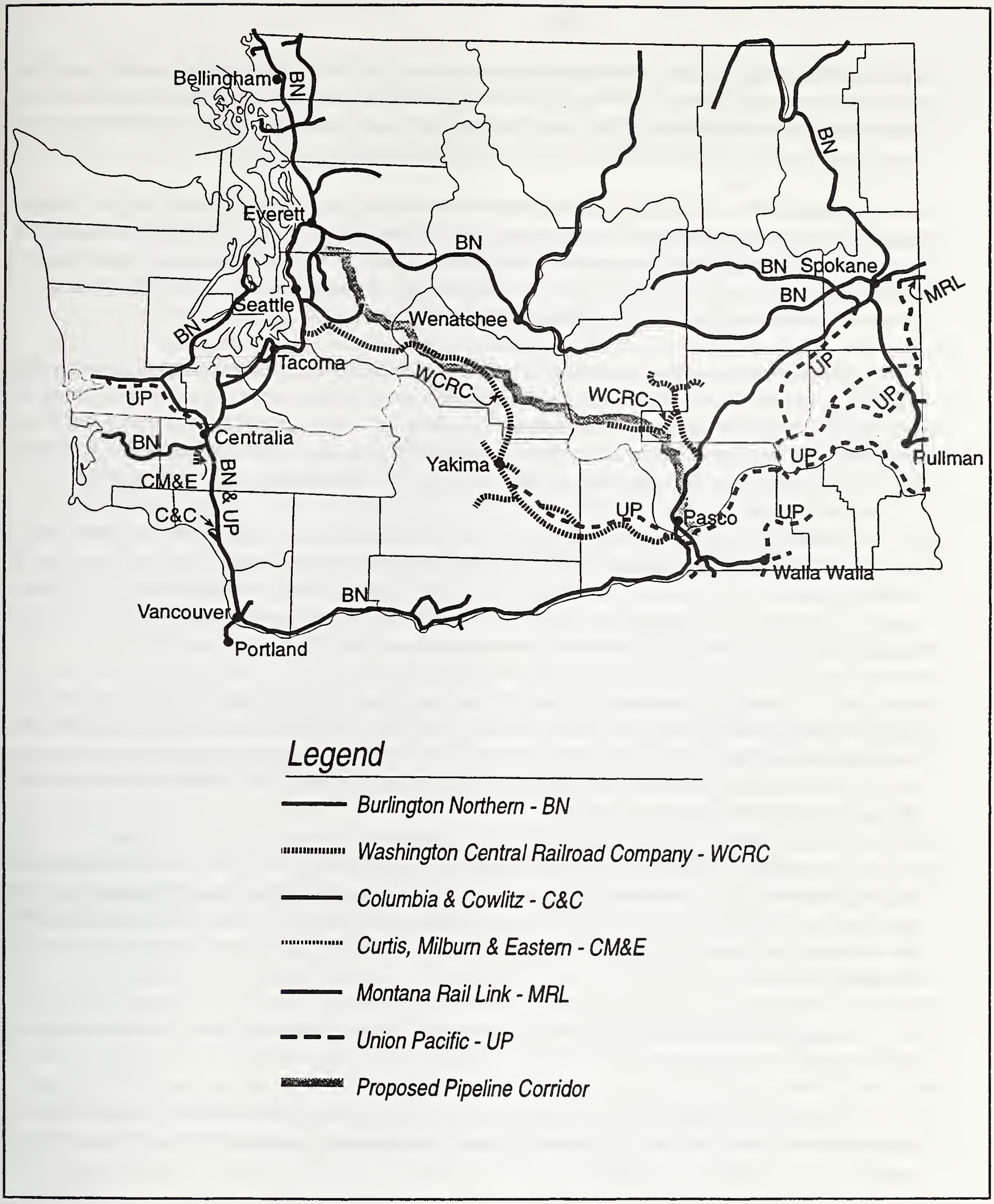
3.10.2.1 Proposed Petroleum Product Pipeline

Construction Impacts. Transportation impacts associated with construction of the proposed project would be minimal. Minor impacts would result from trucks hauling pipe to the job sites, workers traveling to and from the job sites, and boring operations under roads and highways.

In order to distribute pipe along the pipeline ROW, trucks will visit the pipeline staging areas and haul away approximately 20 sections of pipe at a time. OPL estimates that the distribution of pipe along the corridor would take approximately 3 weeks. OPL also estimates that the truck volume to distribute the pipe would range from 15 to 25 trucks, or a total of 30 to 50 total trips, per day. Staging areas have not all been located but are intended to be developed commercial/industrial sites adjacent to major roadways.

Traffic volumes associated with construction of the proposal would not change the existing LOS on roads affected by the proposal. However, very low-volume roads in rural areas would experience a marked increase in traffic for a short period (normally less than 2 weeks for any one road). Despite the increase in traffic, these roadways would continue to operate with only minor delays because one travel lane would always remain open.

To the extent possible, workers would be encouraged to carpool to the construction yard. After arriving at the construction yard, most workers would be bussed to the pipeline site. Some workers (e.g., welders) would drive their own vehicles to the construction site. Because parking would be limited along the route, only construction-related vehicles that were absolutely necessary



RAILROADS IN THE PROJECT VICINITY

Cross Cascade Pipeline
Washington
FIGURE 3.10-2

for the job would be allowed at the pipeline site. Parking for most construction workers would be at a construction yard located near the project site. It would be the responsibility of the construction contractor to provide sufficient parking space for the workers. The longer pipeline spreads (1 and 3) would require a peak of 375 workers or 10 busloads of workers.

The pipeline workforce would be spread over many miles of the ROW as the various sequential construction activities are in progress. For example, the ROW clearing crew would be a few miles ahead of the area being trenched and further ahead of the areas being backfilled after the pipeline has been installed. As a result, vehicles needed along the corridor would be spread over many miles and would not be congregated at any one area.

There would be temporary and minor traffic delays during construction across roadways that are being trenched. Some delay may also be experienced at bridges when the pipeline is placed on the bridge. Trenched roadways would remain open and have flaggers controlling traffic while one lane is being trenched. Steel plates would be placed across the trench or the trench would be backfilled to grade so that traffic can move across the open trench until the pipeline is laid.

Tinkham Road, located south of I-90 and east of North Bend, would have to be closed during construction because the pipeline would be placed in the roadbed, rather than only crossing or running alongside the roadbed as would occur for other affected roads. The duration of this closure would be limited to the actual time required to complete the pipeline installation, approximately 5 days. The roadway would be rebuilt after the pipeline is placed.

Traffic Hazards During Construction. Traffic hazards would increase only slightly as a result of increased construction traffic. One of the more likely sources of traffic hazards would involve the transport of pipes along narrow roads. In some cases, pipe distribution trucks may have to haul sections of pipe 24 m (80 feet) long, which would require pilot vehicles to help negotiate hills and curves in mountainous regions.

Excavation of trenches and pits adjacent to state highways could also present a potential hazard to traffic. To minimize this potential impact, boring pits would be set back as far as is practical from the edge of the traveled roadway, and concrete barriers would be installed to protect the work site from other traffic. Open trenches through roadways would be covered during all non-construction hours.

Other measures proposed by OPL to minimize traffic impacts during the construction period are described in Appendix C.

Operational Impacts. During pipeline operation, very minor traffic volumes would be generated as a result of pump station and pipeline maintenance. Some traffic would occur during operation of the Kittitas Terminal.

During operation of the pipeline, maintenance personnel would visit the pump stations once daily. The pump stations would be located in easily accessible locations close to improved highways. Traffic generated for the maintenance of each pump station would total two round trips per day and would not impact local traffic operations.

Remote valve sites would require occasional maintenance. It is anticipated that each valve site would be visited a minimum of two times per year. Vegetation trimming along the ROW would be required intermittently, probably once or twice per year. Traffic generated for maintenance of the pipeline would be negligible at any one location, totaling less than one round trip per week.

The Kittitas Terminal would be located adjacent to the I-90 westbound off-ramp at Kittitas. Due to the proximity of this facility to the I-90 interchange, a slight hazard to passing motorists would exist. OPL estimates that truck traffic at the Kittitas Terminal would generate approximately 150 total trips per day, generally between the hours of 5 a.m. and 7 p.m. Drivers would have access to the facility 24 hours per day through the use of a card key system. Four employees would be stationed at the terminal; two would work a normal shift at the site, and the other two would be pipeline maintenance personnel who would arrive and depart the facility once or twice per day.

While the additional traffic at the Kittitas Terminal would not impact local traffic operations or the LOS at the I-90 interchange, WSDOT has indicated that the interchange does not meet current design standards. In particular, WSDOT has noted that the existing ramp lane widths (4.3 m [14 feet]) do not meet current design standards (4.6 m [15 feet]) and the existing acceleration and deceleration ramp tapers are not long enough. (WSDOT 1997.) To the extent that interchange improvements at I-90 are required for this project, OPL would negotiate its participation with WSDOT prior to construction of the terminal.

A spill should have little effect on transportation unless a highway was the actual spill location, in which case the roadway would likely be closed until the risk of fire or explosion was removed. A spill on any highway bridge, such as the I-90 Bridge at Vantage, would likely require closing the bridge until all product is recovered. A truck spill involving fire could close roadways for extended periods of time (see Appendix A). Repair work impacts on traffic would be the same as original construction with the likelihood that one lane would be closed.

Use of the Burlington Northern Beverly Railroad Bridge in its current condition could pose an unacceptable risk of pipeline breakage during the life of the project. If this option were selected, structural rehabilitation of the bridge abutments may be required, pending a more detailed review of the structural integrity of the bridge and its abutments.

A benefit of the project is that it would eliminate proration/restrictions on the existing OPL pipeline to Portland. As a result, transport of jet fuel to Sea-Tac and Portland International Airports could meet current and future needs as both airports experience increased ridership and use. It would avoid use of more costly alternative modes of transport for jet fuel. The proposal would also eliminate tanker trucks from arriving at the Kittitas/Ellensburg area late due to lane closures which have closed Snoqualmie Pass, and likely closed Stevens Pass, for 2 to 3 days at a time. Most of the refined petroleum product shipping activity in Puget Sound and along the Pacific Coast from the northwest refineries would be eliminated if the proposed pipeline were built.

Cumulative Impacts. The project would reduce the amount of trucking over the passes but would not have a significant effect on trucking overall. Cumulative impacts of significant reductions in petroleum barge activity in Puget Sound and along the coast combined with elimination

of petroleum barging on the Columbia River would create a significant reduction in such barge transport in Washington.

3.10.2.2 No Action

Continued use of the existing system of petroleum product transport under the No Action Alternative would result in continued proration of the existing Seattle-Portland pipeline's capacity. Thus, shippers would be required to use alternative modes of transport to meet their needs at greater cost. For instance, Sea-Tac and Portland International Airports would have to use trucking or other more expensive means to obtain needed jet fuel.

Under the No Action Alternative, current modes of product transport would continue and would increase in the future. Increased trucking of product would occur to help meet the increased demands for petroleum products in central and eastern Washington. OPL anticipates that trucking would increase from 50 to 60 tanker trucks per day now, to 71 trucks in 1999, 80 trucks in 2004, 90 trucks in 2009, 101 trucks in 2014, and an average of 128 trucks per day in 2026. Although this is an increase in trucking activity, it would not affect LOS on I-90 or other roadways. Increased trucking activity would increase the risk of a spill incident along trucking routes at a higher rate than a pipeline, and any truck accident including a spill would certainly involve a roadway.

Under the No Action Alternative, annual barge use up the Columbia River is expected to increase from 292 trips annually in 1999, to 346 trips in 2014, and 423 barge trips in 2019. As Tidewater Barge continues to replace single-hull barges with larger double-hull barges, the increase may be at a lower rate than this.

Increased ocean barging of product from the four Puget Sound refineries (now at 12 to 20 shipments per month) would also occur under the No Action Alternative, with transfer to the river barges in Portland for transport to Pasco. It is estimated that increases in ocean barging would total 5,800 bbls per day in 1999, up to 35,889 bbls in 2019. Refined petroleum barge activity would continue to increase on Puget Sound, to Harbor Island, through the Strait of Juan de Fuca, and along the coast to Portland. In contract, with the proposal, the volume of petroleum products shipped by ocean barge would be reduced and would be eliminated on the Columbia River above Portland, ultimately depending on product demand in central and eastern Washington.

3.10.3 Additional Proposed Mitigation Measures

3.10.3.1 Construction Mitigation and Subsequent Impacts

No additional mitigation measures beyond those included as part of the project by the applicant are proposed.

3.10.3.2 Operational Mitigation and Subsequent Impacts

No mitigation measures are proposed for operation because operational impacts to transportation would be negligible.

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3.11 CULTURAL AND HISTORICAL RESOURCES

3.11.1 Affected Environment

Historical resources are the tangible, physical remains of past human activity. The age of these resources in the region ranges from thousands of years to recent times. The upper limit for classification as "historical" is generally at least 50 years old. The resources themselves may be sites, buildings, structures, districts or objects. Prehistoric archaeological sites may include habitation areas, lithic scatters, petroglyphs, hunting blinds, cairns, and burial locations. Historic remains represent the activities of Euroamericans in the region for the last two centuries. These remains include buildings, structures, and sites associated with agriculture and settlement (e.g., homesteads, irrigation systems, fences, corrals), mining (e.g., adits, tailings, mills, camps), logging (e.g., mills, spur railroads, camps and equipment) and the development of regional transportation (e.g., roads, railroads and their associated construction camps and maintenance facilities).

In addition, the proposed alignment and facilities cross lands previously occupied and used by numerous Indian groups now represented by the following tribal organizations: the Tulalip Tribes, the Suquamish Tribe, the Duwamish Tribe, the Snoqualmie Tribe, the Muckleshoot Tribe, the Confederated Tribes of the Colville Reservation, the Wanapum Tribe, the Confederated Tribes and Bands of the Yakama Indian Reservation, the Confederated Tribes of the Umatilla Indian Reservation, the Confederated Tribes of the Warm Springs Reservation, and the Nez Perce Tribe. Members of these tribal organizations continue to use these lands and have an interest in preserving traditional values and cultural resources. Particularly important are cemeteries and isolated interments, sacred land forms, ceremonial sites, rock art, cairns, certain animal and plant resources, and locations prominent in mythology and tribal history. Indian groups that cede aboriginal lands through treaties signed with the United States Government have "reserved rights." These include rights specified in the treaties such as the rights to fish at "usual and accustomed grounds and stations," as well as rights not taken away by treaties. Only an act of Congress can take away such rights. Federal agencies must conduct government-to-government consultation with federally recognized tribes when a project has the potential to impact treaty reserved rights.

3.11.1.1 State and Federal Regulations

Washington state laws addressing cultural resources include the Archaeological Sites and Resources Act (RCW 27.53) and the Indian Graves and Records Act (RCW 27.44). The first Act declares the state's interest in the conservation, preservation, and protection of Washington's archaeological resources and prohibits disturbance or excavation of historic or prehistoric archaeological resources on state or private land without a permit from the state. The second Act prohibits knowingly disturbing a Native American or historic grave.

The federal government has, through numerous laws, regulations, and executive orders, developed and supported a national policy of protection and management of historic properties. The

proposal has been identified as an undertaking under 36 CFR Part 800.2(0) because it crosses federal land, requires federal permits and approvals, and therefore is subject to the authority of historic preservation law. The following legislation must be met for areas over which the federal government has authority:

The National Historic Preservation Act (NHPA) of 1966 as amended in 1992 (P.L. 102-575; 16 U.S.C. 470) established the federal government's policy and programs on historic preservation, including the establishment of the National Register of Historic Places (National Register). Heritage resources (i.e., sites, buildings, structures, districts, or objects) that are listed or eligible for the National Register are called historic properties. Section 106 of the NHPA requires federal agencies to take into account the effects of their undertakings, including permitting and licensing, on historic properties. Title 36, CFR 60.4 lists the criteria used to evaluate heritage resources for National Register eligibility. The Section 106 review process consists of four steps: identification and evaluation of historic properties, assessment of effects of the undertaking, consultation to resolve adverse effects, and comment by the Advisory Council. The NHPA also provides for consultation with any Indian Tribe that attaches religious or cultural significance to an historic property that may be affected by a project (NHPA Section 101 [d] [6] [B]).

This legislation has guided the studies undertaken by OPL to date. The proposal is currently in the identification phase; evaluation of the historic resources identified has not begun. Indian tribes have been contacted by OPL about traditional cultural properties and other issues of concern. Federal agencies have also initiated government-to-government consultation with tribes that may have historic property or other issues of concern. Comments have been received from a number of tribal organizations and consultation is ongoing (see Table 3.11-1).

The National Environmental Policy Act (NEPA) of 1969 provides for consideration of environmental impacts of federal projects and for public involvement in decision-making through the Environmental Assessment and Environmental Impact Statement. Section 101(b)(4) declares that one objective of the environmental policy is to "preserve important historic, cultural, and natural aspects of our national heritage . . . "

NHPA Section 106 studies are coordinated with the NEPA process. Identification and evaluation of historic properties and determining effects on them takes place as NEPA documents are developed. The Draft EIS can be used as the basis for consultation to resolve adverse effects. The results of consultation and the terms of any programmatic agreement (PA), which constitutes the Advisory Council comment, can then be included in the Final EIS.

The American Indian Religious Freedom Act of 1978 protects the rights of Native American people to believe, express, and exercise their traditional religions. The Act allows access to sites, use and possession of sacred objects, and freedom of worship through traditional ceremonies and practices. It also requires review (in consultation with Native American leaders) of federal agency policies and programs to determine changes necessary to protect and preserve religious and cultural practices of Native Americans.

The Native American Graves Protection and Repatriation Act of 1990 establishes the rights of Native American groups to human remains of Native American ancestry and certain

associated cultural objects recovered from federal or Indian lands. The Act also establishes procedures and consultation requirements for intentional excavation or accidental discovery of Native American remains on federal or tribal lands.

Table 3.11-1. Indian Groups Contacted by OPL or the USFS

Tribal Organization	Contact	
	OPL	USFS
Confederated Tribes of the Warm Springs Indian Reservation	X	
Confederated Tribes of the Umatilla Indian Reservation	X	
Confederated Tribes of the Colville Reservation	X	
Confederated Tribes and Bands of the Yakama Indian Reservation	X	
Duwamish Tribe	X	
Lummi Indian Business Council		X
Muckleshoot Tribe	X	
Nez Perce Tribe	X	
Nooksack Indian Tribal Council		X
Puyallup Tribal Council		X
Samish Tribe		X
Sauk-Suiattle Tribal Council		X
Snoqualmie Tribe	X	
Stillaguamish Board of Directors		X
Suquamish Tribe	X	
Swinomish Indian Tribal Council		X
Tulalip Tribes	X	
Upper Skagit Tribal Council		X
Wanapum Tribe	X	

Executive Order 13007 -- Indian Sacred Sites (May 24, 1996) directs executive branch agencies to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and to avoid adversely affecting the physical integrity of such sacred sites on federal lands. The agencies are further directed to ensure reasonable notice is provided of proposed land actions or policies that may restrict future access to or ceremonial use of, or adversely affect the physical integrity of, sacred sites.

The USFS as lead federal agency has directed OPL to carry out a three-part plan to gather information necessary for compliance with Section 106 of the NHPA and other applicable laws, regulations and orders. Phase I is the completion of field surveys to identify historic properties that may be affected by the undertaking. Phase II is the gathering of sufficient information to evaluate the eligibility of properties found for the National Register, and Phase III is development of a draft PA stipulating the means by which the agency(s) will fulfill Section 106 responsibilities. A PA is appropriate for projects when the effects on historic properties cannot be fully determined prior to approval. The PA will address such issues as monitoring during construction, treatment of newly discovered properties, and a plan to be applied if leakage, fire, or other emergencies, or control or cleanup procedures occur.

The PA may also include additional stipulations to satisfy state legislation and concerns of state agencies. The State Historic Preservation Office (SHPO) will represent the state's interests, while the USFS will represent the interests of all other federal agencies whose lands are affected by the project in the development and implementation of the PA.

3.11.1.2 Regional Setting and Use by American Indian Groups

The pipeline would traverse three distinct physiographic areas: the Puget Lowlands, the Cascade Mountains, and the Columbia Basin. Each of these areas has characteristic physiography, climate, and soils that supported plant, animal, and other resources that were available to prehistoric and historic inhabitants. Land use -- how and where people lived, both historically and prehistorically -- has been determined by distribution of these resources. The region has been inhabited for at least the last 11,000 years by people who practiced varying degrees of sedentism and settlement specialization as the post-glacial climate and environment of the Holocene changed.

By the time Euroamericans arrived, groups with distinctly different languages occupied each side of the Cascades. Coast Salish speakers were on the west side with Snohomish, Suquamish, Skykomish, and Snoqualmie groups occupying territory in or near the proposed ROW. Snoqualmie territory was inland of Puget Sound, extending from the Tolt River up the Snoqualmie River Valley to Snoqualmie Pass (Baenen 1981; Indian Claims Commission 1974). The Lower Snoqualmie had their main village at the mouth of the Tolt River below Snoqualmie Falls. The Upper Snoqualmie lived in villages in the prairies around present-day Snoqualmie and North Bend.

East of the Cascade Crest, both Interior Salish-speaking Wenatchee and Sahaptin-speaking Upper Yakama or Kittitas bands were historically reported in the upper Yakima River Valley. Farther east, the linguistic differences continued, with the Interior Salish-speaking Sinkiuses and the Sahaptin-speaking Wanapum occupying the land along the Columbia River. Sinkiuse territory extended north from the vicinity of Crab Creek, while Wanapum territory extended south to the Pasco vicinity.

The Medicine Creek Treaty of 1854 and the Point Elliott Treaty of 1855, negotiated in western Washington, established the Tulalip, Port Madison, Puyallup, and Nisqually Reservations for Puget Basin Tribes. The Muckleshoot Reservation was established by executive order in 1857. On the east side of the Cascades, the Yakima Treaty was signed in 1855, creating a reservation for 14 tribes. Executive orders later established additional reservations (e.g., that of the Colville

Confederated Tribes), or changed the boundaries of existing reservations. However, some groups, like the Wanapum and Duwamish, never moved to the reservations and others left reservations to return to their traditional territories.

3.11.1.3 Euroamerican Settlement

Euroamerican settlement of the Seattle and Issaquah area began in the late 1840s. By 1853, Donation Land Claims had been filed in Seattle and in the Squak Valley (present-day Issaquah). The Puget Sound Indian Wars of 1855-56, which started in the White River Valley and extended north to Seattle, temporarily interrupted white settlement of Duwamish lands. Land clearing for agriculture in the interior Puget Basin proceeded slowly. In the 1870s farmers began to work land wherever it was flat enough to be cultivated. By the 1880s, hops was the boom crop in the Snoqualmie Valley.

East of the Cascades, the first permanent settlers arrived in the Kittitas Valley seeking grazing land for livestock. Ranchers moved into the Kittitas and Yakima Valleys from Oregon in the 1860s. They raised cattle for the Colville, Cariboo, and Idaho mines and drove stock over Snoqualmie Pass to Puget Sound markets (Meinig 1968). Ranchers were instrumental in building the eastern segment of the Snoqualmie Pass Wagon Road, which was completed in 1867. This route became the primary means of moving stock to Puget Sound before the railroad was completed. Markets for livestock were also found in mining and logging camps adjacent to the pipeline corridor (Prater 1981).

Markets for livestock were also found in mining and logging camps adjacent to the pipeline corridor (Prater 1981). Hard-rock mining for metals was of little consequence in the region. However, coal mines, which developed near Issaquah, Roslyn, and Cle Elum, were much more profitable. These mines began in the 1870s and some continued working into the 1960s.

In 1887, the Northern Pacific completed its transcontinental railroad to Tacoma, crossing the Cascades over Stampede Pass rather than Snoqualmie Pass. The Chicago, Milwaukee, and St. Paul Railroad (later the Chicago, Milwaukee, St. Paul and Pacific, known as the Milwaukee Railroad) constructed a line over Snoqualmie Pass in 1909, which completed a link between Seattle and the Midwest via Ellensburg. This route gave the Milwaukee Railroad access to the expanding trade in timber and grain from the Northwest to markets in the Midwest.

The railroads made the removal of large quantities of timber possible, as cutting areas were connected to the main line by railroad spurs. The Northern Pacific was awarded alternating sections adjacent to its line by the federal government as payment for construction of the railroad. These and other timberlands in the Cascades fed the mills. Mills were built in most towns by 1890, including Seattle, Renton, Issaquah, and North Bend, and large logging camps were established at several places east of North Bend, including Garcia, Denny Creek, Snoqualmie Pass, and Keechelus Lake. Lower elevation areas in the vicinity of the pipeline corridor were mostly logged by the mid-1920s, while logging at higher elevations occurred somewhat later, in the 1930s to 1950s (Hollenbeck 1987; West Coast Lumberman 1944).

The railroads also spurred the development of agriculture on marginal lands. Private investors tried to construct irrigation systems, but by the early twentieth century, promoters had recognized

the importance of government involvement in irrigation projects. The U.S. Reclamation Service took over 55 canal systems between Cle Elum and the mouth of the Yakima River in 1906, forming the Yakima Project (Coulter 1951:115). Reservoirs were created at Lakes Keechelus, Kachess, and Cle Elum between 1911 and 1933 to supply irrigation systems in the Kittitas and Yakima Valleys. East of the Columbia River, similar development awaited the Columbia Basin Project which used water diverted by Grand Coulee Dam to irrigate farmlands and orchards in Franklin, Grant, and Adams Counties.

In the latter half of the twentieth century, increasing use was made of barges on the Columbia River and trucking on interstate highways to move produce and freight. The Milwaukee Railroad abandoned its lines in Washington in 1980, and the State of Washington acquired the ROW from Easton to the Washington-Idaho line. The state used the grade to establish the John Wayne Trail/Iron Horse State Park.

3.11.1.4 Historical Resources along the Pipeline Corridor

Field investigations were conducted along a 61 m (200-foot) wide corridor, centered on the centerline of the proposed pipeline. Approximately 97 percent or 362 km (224.8 miles) of the 372 km (231-mile) corridor has been surveyed. Table 3.11-2 presents the results of this survey and the relationships of the identified locations to the centerline. Mapped locations are included in Appendix E of the cultural resources assessment report prepared for this proposal (Heritage Research Associates and Dames & Moore 1997). These locations and reports of each site are confidential under Section 304 of the NHPA to prevent vandalism. The USFS will review the data as they are provided by OPL and determine if they are adequate to evaluate resources on federal land. Following Section 106 procedures, the agency, in consultation with the SHPO, will evaluate each resource for significance using criteria established by the NHPA.

Twelve prehistoric sites, 24 historic-period sites, two dual component (prehistoric and historic period) sites, 51 prehistoric isolates, and 137 historic-period isolates have been identified. Of the 12 prehistoric sites, none has been listed or determined eligible for the National Register (Table 3.11-2). Of the 24 historic-period sites, one has been listed on the National Register.

Nearly all of the prehistoric isolates consist of one or a few artifacts, primarily flakes or chunks of cryptocrystalline silicas or petrified wood (n=34); others were projectile points, bifaces, modified flakes, and four cairns. Most of the historic isolates are irrigation ditches or features (n=128) in the Kittitas Valley and east of Vantage. Other historic isolates included building materials, machinery parts, cans, bottles, rock piles from field clearing, telephone insulators, wire-wound wood pipe, discarded appliances, and road and railroad beds (Table 3.11-3).

Table 3.11-2. Sites Identified Within the 200 ft Survey Corridor

Atlas[1]	Other No.[2]	Description	Distance from Centerline	Owner	NRHP Status
14-1		Memorial bench monument--concrete bench with steps	10-15 meters	Private	Undetermined
CMSt.P& P RR		Chicago Milwaukee, St. Paul, and Pacific Railroad--includes the grade and 42 isolated artifacts or features including: culverts (2), road (1), boxcar (1), timbers, ties & spikes (6), inactive power line segments (4), bridges/trestle (5), footings, pilings & foundations (15), track sections (3), signal poles (2), tunnel (1), grade (1), insulator pegs (1)	Various	State Parks & Rec. Comm.; MBSNF	Undetermined
21-2	CR05-05-61	Minot Spur debris scatter	0-7 meters	MBSNF	Undetermined
	45KI158	Harris Creek railroad trestle	15 meters	MBSNF	No
21-6, 29-5, 30-7, 30-8		Four segments of the Snoqualmie Wagon Road	0-152 meters	MBSNF/Private	Undetermined
23-1	45KI442	Historic period refuse scatter	0-35 meters	MBSNF	Undetermined
24-1	CR05-05-51	Chicago Milwaukee St. Paul and Pacific Railroad Tunnel	0 meters	MBSNF/ Private	Undetermined
25-6		Milwaukee Railroad laborer housing	76.2 meters	Private	Undetermined
28-10		Railroad siding and artifact scatter (Whittier Site)	10-40 meters	WNF	Undetermined
36-1		Foundation	10-20 meters	Private	Undetermined
41-2	45KT1086	Dump	15-30 meters	Private	Undetermined
52-5		Railroad depot complex	0-50 meters	City of Kittitas	Listed
52-6		Foundation and debris piles	20-40 meters	Private/ City of Kittitas	Undetermined
52-7		Foundation	15-40 meters	Private/ City of Kittitas	Undetermined
52-8		Foundation	0-3 meters	Private/ City of Kittitas	Undetermined
52-9		Foundation and debris scatter	15-25 meters	Private	Undetermined
53-2		Foundations and refuse scatter	10-30 meters	Private	Undetermined
53-4		Agricultural complex	0-50 meters	Private	Undetermined
54-2		Electricity and telephone line insulators	10-15 meters	Private	Undetermined
54-3		Electricity and telephone line insulators	10-15 meters	Private	Undetermined
55-4		Agricultural complex (Steiner Property)	10-50 meters	U.S. Army	Undetermined
62-1	45KT1083	Lithic scatter	0-15 meters west 0-30 meters east	U.S. Army	Undetermined
62-10		Lithic scatter	0-20 meters north 0-100 meters south	U.S. Army	Undetermined
62-11	45KT1084	Lithic scatter	15-30 meters	U.S. Army	Undetermined
64-2		Railroad camp	0-20 meters south 0-50 meters north	BLM	Undetermined
64-3	45GR672	Rock piles, historic debris, and lithic scatter	0-120 meters	BOR	Undetermined
68-3		Homestead	0-76 meters	BOR	Undetermined

Continued

Table 3.11-2. Sites Identified Within the 200 ft Survey Corridor

Atlas[1]	Other No.[2]	Description	Distance from Centerline	Owner	NRHP Status
82-1	45AD106	Dump	0-10 meters south 0-100 meters north	BOR	Undetermined
88-1	45FR403	Dump	0-40 meters	BOR	Undetermined
IN3-2		Developed spring and lithic scatter	0-75 meters north 0-75 meters south	Ginkgo State Park	Undetermined
IN11-4		Lithic scatter	0-10 meters	Ginkgo State Park	Undetermined
IN12-1		Lithic scatter	0-80 meters north 0-100 meters south	Ginkgo State Park	Undetermined
IN12-4		Lithic scatter	0-50 meters north 0-100 meters south	Ginkgo State Park	Undetermined
IN12-10		Lithic scatter	0-20 meters	Ginkgo State Park	Undetermined
IN12-13		Lithic scatter	0-20 meters	Ginkgo State Park	Undetermined
IN12-14		Lithic scatter	0-50 meters north 0-50 meters south	Ginkgo State Park	Undetermined
IN12-15		Lithic scatter	0-30 meters north 0-120 meters south	Ginkgo State Park	Undetermined
IN36-1		Lithic scatter	0-3 meters east 0-3 meters west	Ginkgo State Park	Undetermined

[1]The "Atlas" number refers to the Cultural Resources Assessment Report Appendix E page number with pages and sites numbered from west to east along the survey corridor.
[2]Other site numbers are state Smithsonian designations (e.g., 45KI132) or U.S. Forest Service designations (e.g., CR05-05-61).

Table 3.11-3. Isolates Identified Within the 200 ft Survey Corridor

No. of Isolates	Resource Description	No. of Isolates	Resource Description
1	Aligned railroad ties	1	Telephone line insulator
1	Amethyst glass bottle base, rectangular	1	Tin can scatter (recent)
1	Amethyst glass bottle fragments	2	Tobacco tin
1	Brick and cobble pile	1	Trailer and dozer blades
1	Brown glazed stoneware fragment	1	White transfer-print earthenware fragment
1	Cairn and CCS flake	1	Whiteware and glass fragments
3	Cairn	1	Whiteware ceramic fragment, embossed
1	Cairn (recent)	2	Wire-wrapped wood pipe
1	Can	1	Wood timber/pole
1	Concrete pier	1	Wood timbers
1	Concrete well	1	Wood foundation
1	Cut sandstone block	1	Wooden power pole
1	Fragmented 1920s truck parts		
3	Granite cobbles		
1	Grooved fence weight		
1	Historic farming plow/rake		
1	Historic farming equipment		
1	Hole-in-top can		
1	Irrigation ditch gate		
1	Irrigation diversion box		
79	Irrigation ditch		
1	Large wooden timber		
1	Large rusted metal cylinder		
45	Lithic isolates		
1	Mounded earth and timbers		
1	Possible bridge remains		
1	Railroad grade		
1	Refrigerator		
4	Roadway		
11	Rock pile(s)		
1	Rock piles aligned N-S (old fence line)		
1	Spring box, concrete		
1	Stacked wood timbers		
	Stripped cedar tree (possibly recent)		

Source: Heritage Research Associates and Dames & Moore 1997.

3.11.1.5 Indian Tribal Consultation

OPL initiated consultation with both federally and non-federally recognized tribal organizations to discuss traditional cultural properties and other concerns (Table 3.11-1). The purpose of the consultation is to request information and provide opportunities for the tribes to state their concerns about cultural resources and environmental topics. In addition to interest in historical and traditional cultural properties, tribes may have concerns about burials, certain minerals, and native plants and animals and their habitats. Most of the tribes listed in Table 3.11-1 had aboriginal territories that included the proposed pipeline corridor. Two of the groups, the Warm Springs and Nez Perce, were included in the consultation because of treaty rights for fishing in the Columbia River system. A number of tribal organizations have responded to letters regarding the project proposal, and consultation continues.

3.11.2 Environmental Consequences

3.11.2.1 Proposed Petroleum Product Pipeline

Construction Impacts. Construction of the pipeline within an 18 m (60-foot) corridor has the potential to disturb or destroy historic properties that are located at the ground surface and to a depth of at least 1.8 m (6 feet). Other disruption to surface material may result from use of the corridor to stockpile excavated material and fabricate pipeline segments, equipment maneuvering, and construction vehicle traffic. Boring and horizontal directional drilling will be employed at road crossings, canals, and larger streams and rivers. This method would require the excavation of drill pits larger than the pipeline trench but within the 18 m (60-foot) corridor. OPL may be able to adjust the construction alignment to avoid all or most sites within the 61 m (200-foot) wide corridor that was surveyed for heritage resources. Once identification of resources is complete, OPL will identify which properties will likely be impacted and consult with the USFS to finalize a scope of work for testing and evaluation of properties should avoidance not be an option.

Until consultation with the Indian tribes is concluded, effects on traditional cultural properties or other resources that might be of concern cannot be determined. This consultation will continue and is not expected to be completed until after the Draft EIS is issued.

Columbia River Approach Options. One area where avoidance may prove difficult is the proposed Ginkgo State Park route, where surveyors encountered prehistoric sites that cover large areas. Survey of the YTC corridor segment options has not been completed.

Columbia River Crossing Options. Each of the options has a different alignment required to reach the actual crossing. Based on current information, crossing the I-90 Bridge would have the least impact to known cultural resources and the least potential for new discovery of heritage resources during construction. Two historic sites, isolated railroad ties, and three prehistoric isolates were found on the approaches to the boring site. The approaches to the remaining three options have not been completely examined.

Operational Impacts. OPL would operate the pipeline within a 9 m (30-foot) wide permanent easement located within the 18 m (60-foot) construction corridor. Normal operation of the pipeline and its ancillary facilities would not affect known significant resources. Leakage, fire, or other emergencies and control or cleanup procedures could affect cultural resources. The criteria of effect in 36 CFR 800.9 would be applied to historic and traditional cultural properties in consultation with the Office of Archaeology and Historic Preservation (OAHP) following protocols established in the PA for an emergency management plan.

Cumulative Impacts. The pipeline would be sited to avoid impacts to significant cultural and historical resources as much as possible. Studies are ongoing to identify and evaluate properties. If any historic properties are affected by the pipeline, then the pipeline would contribute to the cumulative loss or alteration of historic properties significant to the Nation's heritage.

3.11.2.2 No Action

No cultural resources would be affected by the No Action Alternative from construction or normal operation. However, the increased barge and truck traffic increases the probability of accidental damage from spills to identified and as yet undiscovered sites along the Columbia River below Pasco and along the I-90 corridor.

3.11.3 Additional Proposed Mitigation Measures

Phase II results will include recommendations for treatment for historic properties as needed with property and location-specific mitigation plans. If the properties are of value only for their research potential, and the SHPO approves data recovery as mitigation, then a determination of no adverse effect can be achieved. Mitigation measures for traditional cultural properties, or properties judged significant for reasons other than research potential, may require mitigation measures other than data recovery.

A plan specifying treatment of human remains discovered during construction or operation that fulfills the requirements of the Native American Graves Protection and Repatriation Act must also be developed.

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3.12 LAND AND SHORELINE USE

3.12.1 Affected Environment

The proposal extends through six counties (Snohomish, King, Kittitas, Grant, Adams, and Franklin) and four cities (Snoqualmie, North Bend, Kittitas, and Pasco), primarily through undeveloped land.

3.12.1.1 Existing Land Uses along Pipeline Corridor

General. Most of the pipeline corridor would be located on undeveloped rural land devoted to natural resource uses (forest and recreation) and agricultural uses (rangeland and crops), with the exception of residential areas primarily near the western end of the corridor through Snohomish and King Counties.

Approximately half of the pipeline corridor (47 percent, 176 km or 109 miles) could be located within existing cleared ROW, including the BPA transmission corridor in western Washington, the Cedar Falls Trail and John Wayne Trail (recreation trails), and on USFS and other roads. Approximately one-quarter of the corridor (24 percent, 90 km or 56 miles) would be located immediately adjacent to existing cleared corridors, primarily roadways.

Existing land uses and zoning designations along the pipeline corridor and at the Kittitas Terminal are described and illustrated in the ASC land use section and map atlas (OPL 1998). The following land use categories are used to generally describe the area within 1.6 km (1 mile) on either side of the pipeline corridor: urban and rural residential, forest, agriculture, rangeland, and recreation.

Most of the pipeline corridor crosses unincorporated lands through six counties, but it does pass through four cities (Snoqualmie, North Bend, Kittitas, and Pasco). The portion of the pipeline corridor that extends through Snoqualmie and North Bend has the greatest development and diversity of land uses, including commercial; recreational; and urban, suburban, and rural residential. This segment of the corridor is within the Cedar Falls Trail ROW, a recreation trail managed by King County. The segments of the corridor that extend through Kittitas and Pasco are relatively undeveloped areas of town.

Residential Structures. There are no residential structures within the construction corridor, although the corridor is near some residences and extends through some larger rural residential properties. Although the residences do not directly abut the corridor, they would be within 305 m (1,000 feet) of the centerline.

The corridor utilizes existing cleared ROW in Snohomish County and in the Cities of Snoqualmie, North Bend, and Kittitas, and there are residences near the corridor. In Snohomish County, the construction corridor is located within the existing BPA transmission line ROW,

extending through a suburban/rural residential area. In Snoqualmie and North Bend, the construction corridor is located entirely within the existing Cedar Falls Trail ROW, which extends through urban/suburban residential areas. In Kittitas, the construction corridor is along the John Wayne Trail until turning south (extending along the edge of roadways and cropland) to the Kittitas Terminal.

The pipeline corridor crosses 450 privately owned properties, approximately 90 percent of which are rural residences ranging in size from 0.4 to 16,188 ha (1 to 40,000 acres). The portion of each property crossed ranges from a small portion to miles.

There are five mobile home parks along the pipeline corridor, four in or near North Bend (in King County) and one in Franklin County. Two of the mobile home parks are within 30.5 m (100 feet) of the centerline as identified in the ASC. However, the closest mobile home is approximately 27 m (90 feet) from the centerline.

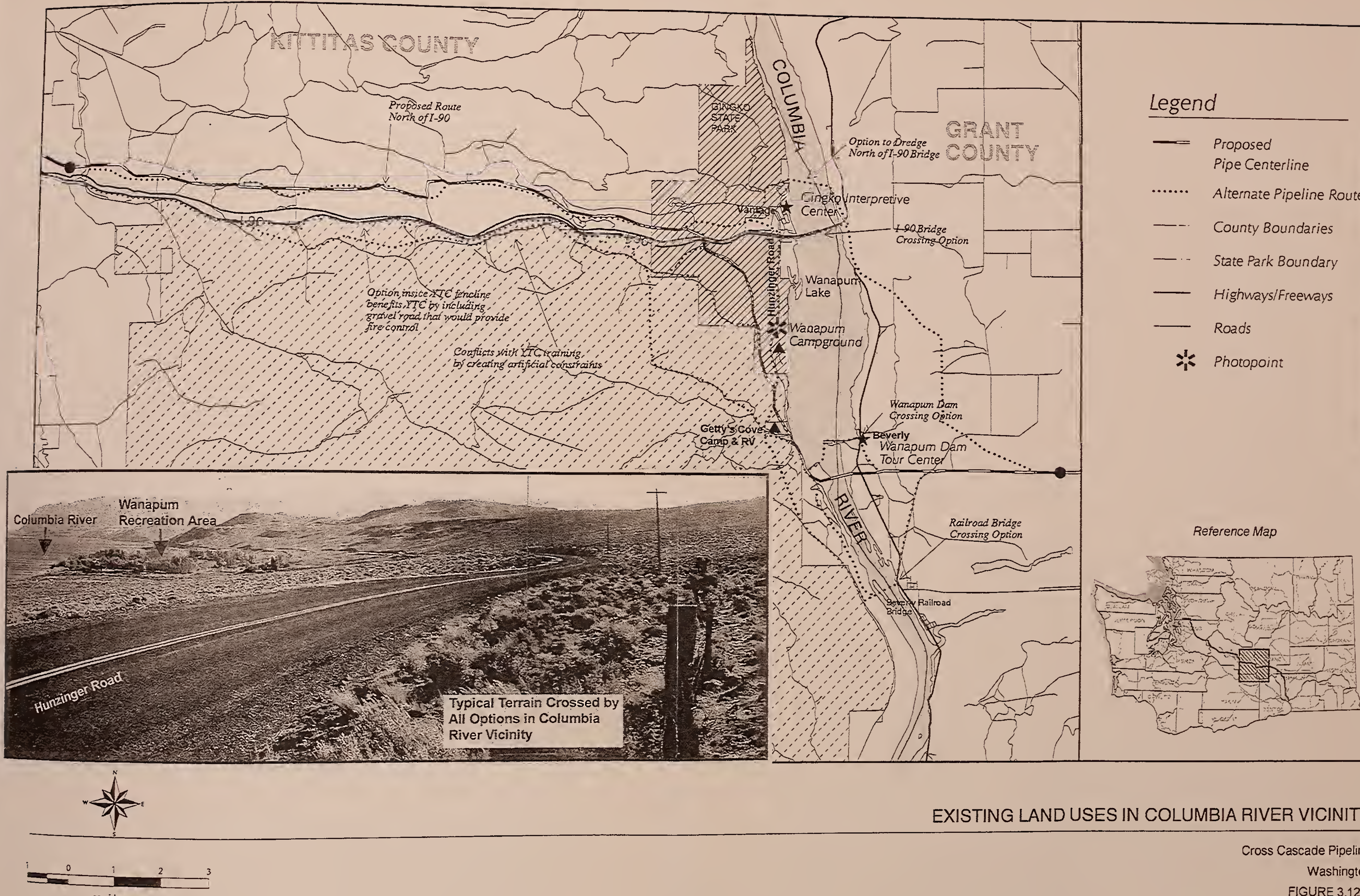
Non-Residential Structures. The ASC also identifies the proximity of non-residential structures along the pipeline corridor, including churches, schools, motels, medical facilities, and public facilities. All non-residential structures are at least 30.5 m (100 feet) from the centerline (most are over 305 m or 1,000 feet from the centerline). Exceptions include some highway commercial uses (two gas stations and a cafe) adjacent to the Kittitas Terminal, which is near an I-90 interchange.

Construction Staging Areas. Existing land uses at the 6 to 12 ha (15- to 30-acre) pipe staging areas and 4 to 8 ha (10- to 20-acre) contractor construction yards are not specifically known because the locations have not been finalized. However, candidate sites include graded or paved log storage yards or similar industrial uses. The final sites would be located on areas already disturbed and not adjacent to any sensitive land uses (i.e., residents and schools) or sensitive natural resources (i.e., creeks). The ASC specifies that the staging areas would be located adjacent to active or refurbished rail sidings.

Existing Land Uses in Columbia River Vicinity. Several pipeline options are being considered at the Columbia River crossing. Major areas through which the corridor could cross include the Yakima Training Center and Ginkgo Petrified Forest State Park on the west side of the river.

The proposed pipeline corridor would cross Ginkgo Petrified Forest State Park, which consists of approximately 3,238 ha (8,000 acres) located on the west side of the Columbia River and on both the north and south sides of I-90 (Figure 3.12-1). The state park is primarily undeveloped land covered with scrub vegetation. The terrain is hilly and steep in many parts, except along the river where it is generally flat. Developed facilities include the state park interpretive center, approximately 1.6 km (1 mile) north of I-90, and the Wanapum Recreation Area, approximately 3 to 5 km (2 to 3 miles) south of I-90. The interpretive center includes a museum and trails (paved/unpaved) which demonstrate exhibits of petrified forest. The Wanapum Recreation Area includes a campground with 50 sites, facilities, picnic area, and boat launch. South of the state park is Getty's Cove Camp and RV Park, a privately owned facility with 120 sites and watercraft rental. (Carter pers. comm.)

The 131,932 ha (326,000-acre) Yakima Training Center (YTC), which is owned and operated by the U.S. Army, is located south of I-90 and west of the Columbia River and Ginkgo Petrified



EXISTING LAND USES IN COLUMBIA RIVER VICINITY

Cross Cascade Pipeline

Washington

FIGURE 3.12-1

Forest State Park. Alternative routes for the pipeline could traverse the YTC (Figure 3.12-1). The U.S. Army expanded the 106,841 ha (264,000-acre) historical YTC in 1992 by 25,091 ha (62,000 acres) to acquire the northern expansion area, including the property affected by possible alternate routes for the pipeline. The northern expansion area remained in use for open livestock grazing until April 1997 when the Army began training and maneuvers. The northern expansion area, like most of the property, is used for training exercises and covered with shrub-steppe vegetation. Training activities, which extend as far north as the I-90 boundary, include infantry training and mock battles with mechanized tanks and other fighting equipment. Continued future use of these areas for training maneuvers is planned. (Krueger pers. comm.)

3.12.1.2 Existing Land Uses at Pump Station and Kittitas Terminal Sites

Table 3.12-1 presents the existing land uses and zoning at the proposed above-ground structures (six pump stations and storage/distribution facility), as well as the adjacent land uses. All the sites are undeveloped. There are no residences directly adjacent to the pump station sites, although there are some residences near (i.e., within 305 m or 1,000 feet) the Thrasher and North Bend Pump Station sites.

The Thrasher site in Snohomish County is under transmission lines within cleared BPA ROW, situated on Maltby Road and surrounded by rural/suburban residential (much of it forested) (Figure 3.12-2). The closest residence to the Thrasher Pump Station site is north of the station across Maltby Road.

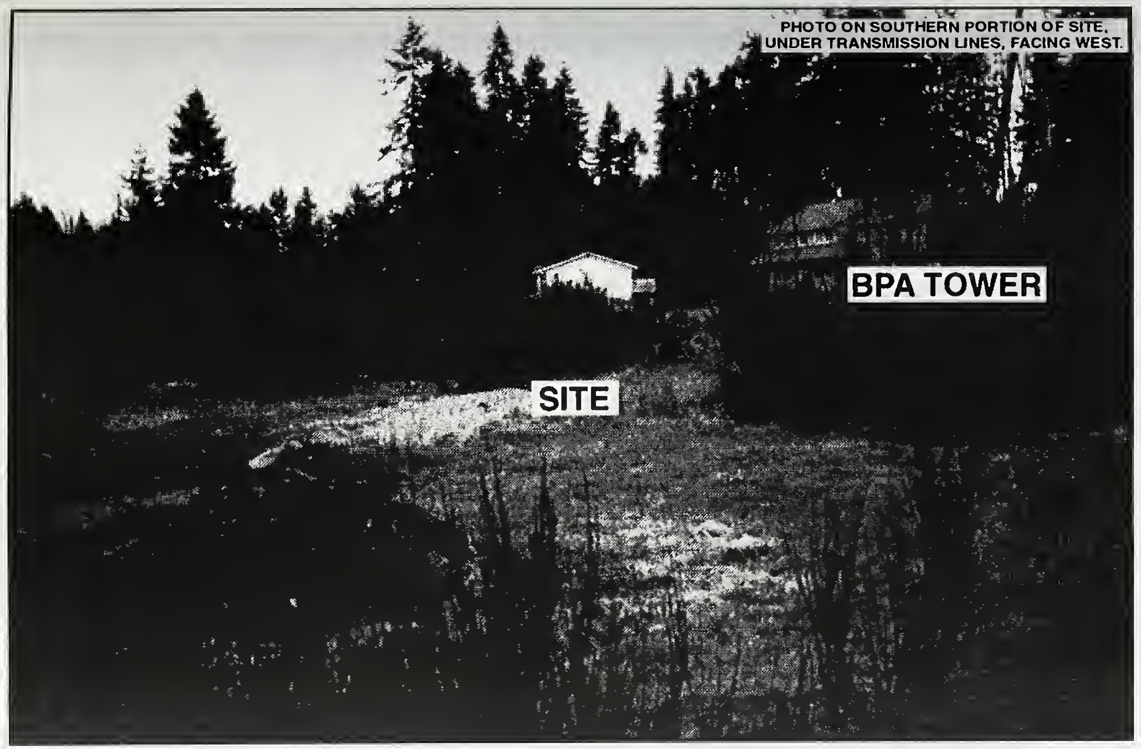
The North Bend site is undeveloped and covered with grasses and blackberry bushes, surrounded by undeveloped land, the Cedar Falls Trail, Puget Sound Energy's North Bend Substation, and the USFS North Bend Ranger Station (Figure 3.12-3). The closest residences to the North Bend site are located west of the station across Thrasher Road (Figure 3.12-3). The pump station site and the adjacent area to the west/northwest are currently undeveloped, unincorporated land zoned by the county for regional business. However, it is within the city's urban growth area (UGA) and shown on the city's zoning map as low-density residential (formerly general commercial).

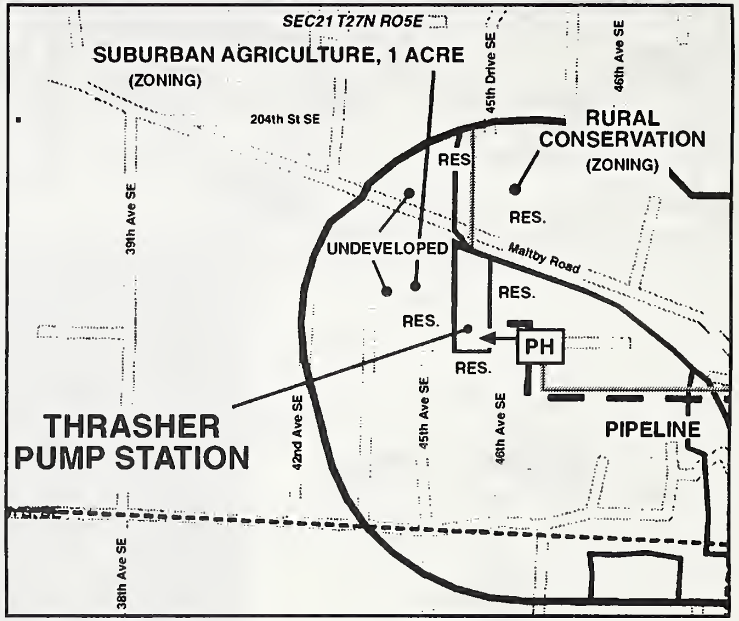
The Kittitas Terminal site is in agricultural use. Adjacent uses include agriculture to the north and east, the I-90 interchange to the south, and highway commercial (two gas stations and a cafe) to the west. The area is transitioning from agricultural to commercial use as the City of Kittitas develops south toward the freeway (Figure 3.12-4).

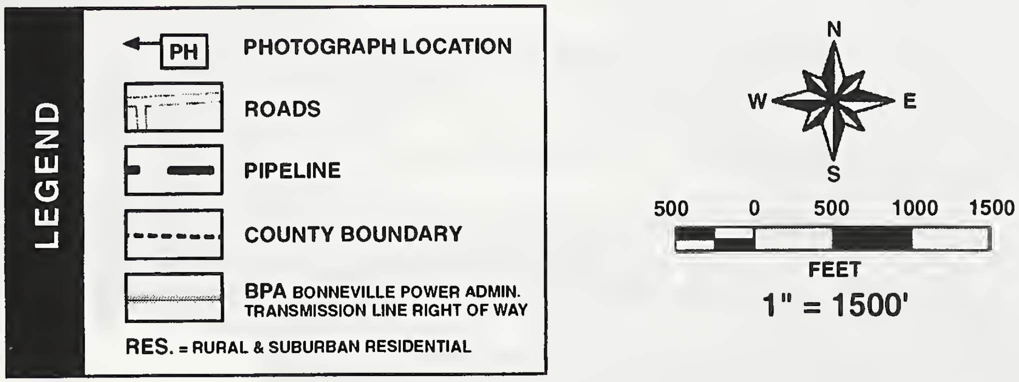
The Stampede, Beverly-Burke, and Othello Pump Station sites are undeveloped land adjacent to undeveloped land. The Stampede Station would be located on a site owned by OPL. It is a clearing surrounded by Wenatchee National Forest lands. The site is triangular-shaped, with Stampede Pass Road adjacent on one side, the John Wayne Trail adjacent on the other, and a telephone utility repeater station (small structure) to the north. The John Wayne Trail, which is an unimproved, abandoned railroad bed in most places, is in the early stages of development. Some locations have been improved for public access and vegetation cleared to facilitate working and biking. The trail includes the Snoqualmie Tunnel which is closed in winter.

Table 3.12-1. Existing Land Uses Onsite and Adjacent to Pump Stations and Terminal

Above-Ground Structure	Existing Land Use/Zoning	Adjacent Existing Land Use
Thrasher Pump Station *(3.67 acres - Segment 1)* See Figure 3.12-2	Vacant/undeveloped with some shrubs within BPA ROW (under transmission lines). Snohomish County Zoning: suburban agriculture.	Rural/suburban residential and forest. Adjacent to Maltby Rd. on the north.
North Bend Pump Station *(1.1 acres - Segment 15)* See Figure 3.12-3	Vacant/undeveloped field covered with grasses and blackberry bushes. King County Zoning: regional business (within City of North Bend urban growth area - rezoned from general commercial to low- density residential).	Northeast: Adjacent to Cedar Falls Trail on the northeast with open fields and rural residential beyond. Southeast: Undeveloped land zoned multi-family residence by city. Northwest: Undeveloped land zoned regional business by county, and Puget Sound Energy substation. Southwest: USFS North Bend Ranger Station. Suburban residential further west across Thrasher Rd.
Stampede Pump Station* *(2.0 acres - Segment 26)*	Partially cleared area owned by OPL in Wenatchee National Forest. Kittitas County Zoning: commercial forest.	Forest and recreation (nearby campground). Telephone utility repeater station to the north. John Wayne Trail adjacent to the northeast. Stampede Pass Rd. adjacent to the northwest.
Kittitas Pump Station and Supply/Distribution Terminal *(27 acres - Segment 33)* See Figure 3.12-4	Irrigated agriculture. Kittitas County Zoning: agriculture (within City of Kittitas urban growth area shown as general industrial).	North/East: Agriculture. South: I-90 freeway with agriculture beyond. West: Two gas stations/cafe, adjacent to Badger Pocket Rd. and I-90 freeway interchange.
Beverly-Burke Pump Station* *(2.0 acres - Segment 33)*	Uncultivated rangeland. Grant County Zoning: Agriculture.	Uncultivated rangeland and agriculture. Adjacent to circular irrigation agriculture to south and Beverly-Burke Rd. to north.
Othello Pump Station* *(2.0 acres - Segment 33)*	Agriculture. Adams County Zoning: Agriculture.	Agriculture (orchards). Adjacent to irrigation pond on the east and Mound Rd. on the west.

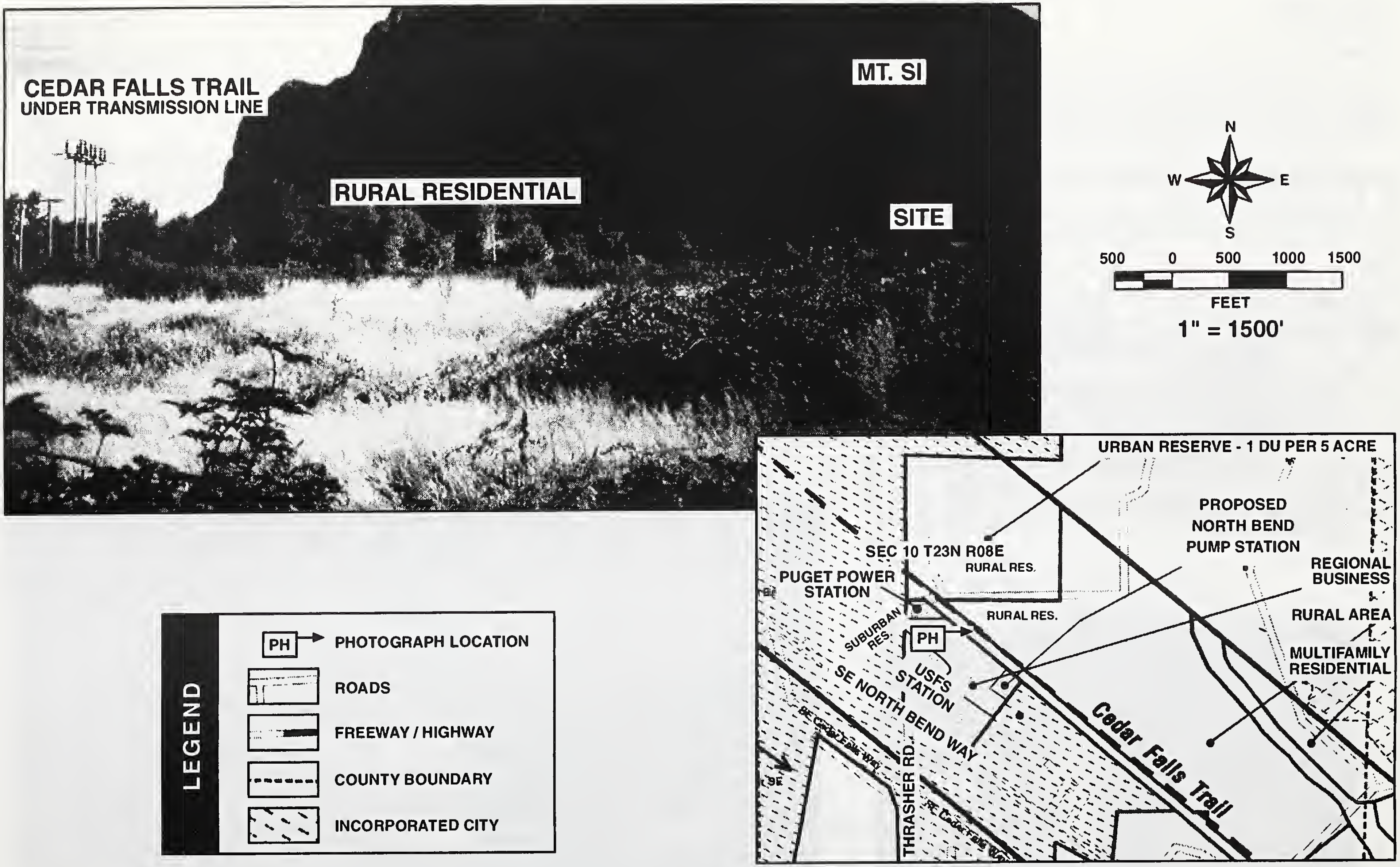






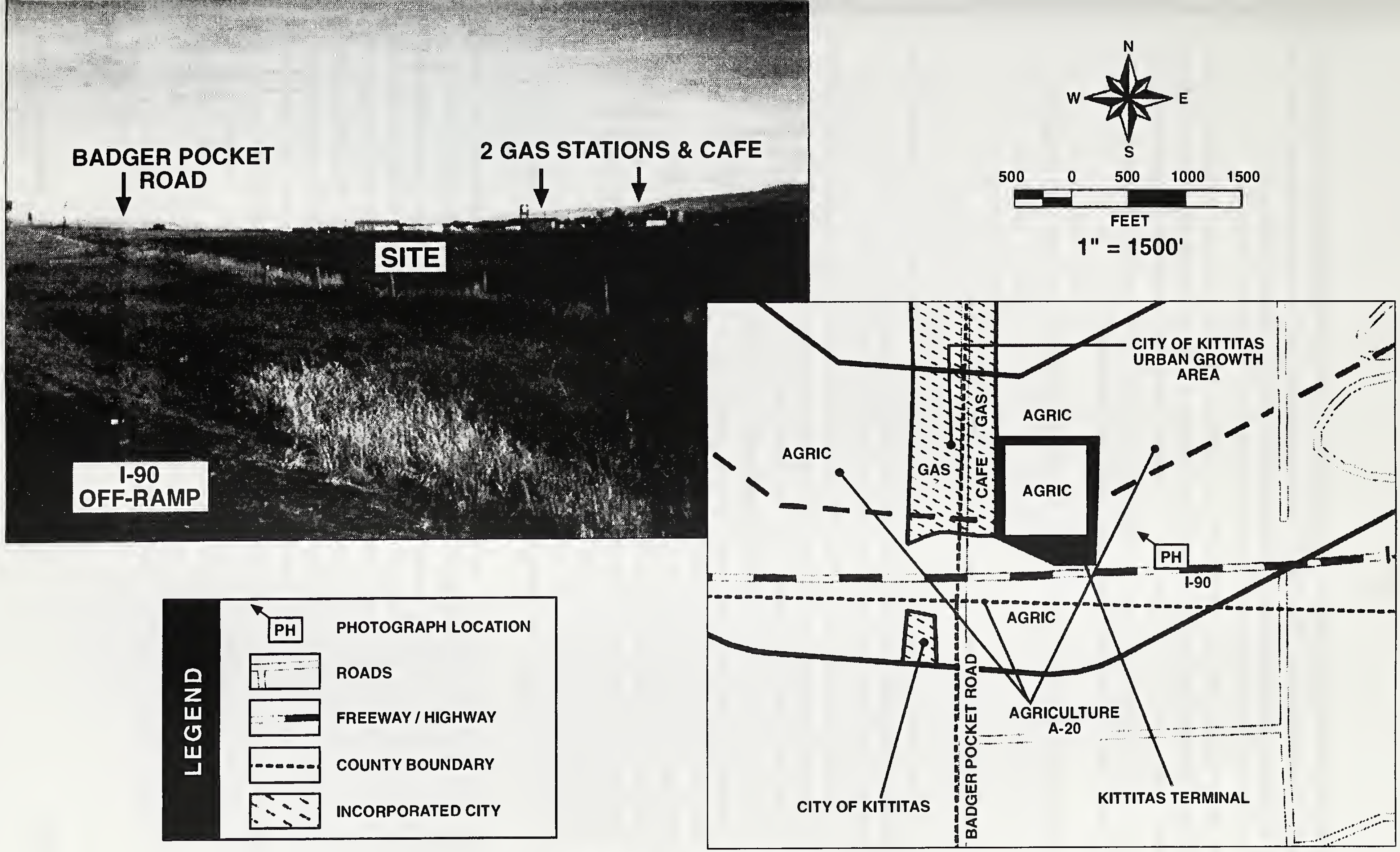
EXISTING LAND USES
AT THE THRASHER PUMP STATION SITE

Cross Cascade Pipeline
Washington
FIGURE 3.12-2



EXISTING LAND USES
AT THE NORTH BEND PUMP STATION SITE

Cross Cascade Pipeline
Washington
FIGURE 3.12-3



EXISTING LAND USES
AT THE KITTITAS TERMINAL

Cross Cascade Pipeline
Washington
FIGURE 3.12-4

The Beverly-Burke site is uncultivated rangeland situated on Beverly-Burke Road, surrounded by rangeland and agricultural land. The Othello site is agricultural land situated on Mound Road and surrounded by agricultural land, including orchard crops and an irrigation pond.

Other above-ground structures include block valves along the pipeline and a metering station at the Northwest Terminalling Facility in Pasco, an existing facility in an industrial area. The block valves would require a 9.1 by 12.2 m (30- by 40-foot) area and would be located within the construction corridor, which includes existing and disturbed ROW and approximately 103 km (66 miles) of new corridor extending primarily through agricultural land.

No above-ground structures are proposed to be located within any 100-year floodplain.

3.12.1.3 Relevant Federal and State Plans and Guidelines

The pipeline corridor extends through lands managed by federal and state agencies. Plans, guidelines, projects, or legislation that are relevant to the proposal include:

- Mt. Baker -Snoqualmie National Forest Land and Resource Management Plan (USFS)
- Wenatchee National Forest Land and Resource Management Plan (USFS)
- Bureau of Land Management's (BLM) Spokane District Management Plan
- Snoqualmie Pass Adaptive Management Area Plan (USFS/USFWS)
- Columbia River Basin Ecosystem Management Project Eastside Plan (USFS/BLM)
- Bonneville Power Administration Standards and Regulations (BPA)
- Yakima and Columbia Basin Projects (BOR)
- Columbia National Wildlife Refuge Manual (USFWS)
- National Environmental Policy Act
- Washington State Environmental Policy Act
- State of Washington Growth Management Act
- State of Washington Shoreline Management Act

The proposal must be consistent with these plans, including any amendments and other plans or plan provisions they adopt. For example, the Northwest Forest Plan (NFP) seeks to conserve late-successional forest and foster healthy watersheds. It manages habitat for late-successional and old growth forest-related species within the range of the northern spotted owl (USFS/BLM 1994). The NFP amends all USFS land management plans and BLM resource management plans. NFP standards and guidelines apply to projects, permits, and special use authorizations in the geographic area covered by the USFS or BLM plan, including the proposed pipeline. Where standards and guidelines of the NFP conflict with those of individual plans, the more restrictive standard and guideline generally applies. The consistency of the proposal with relevant plans and guidelines is discussed in the "Environmental Consequences" section.

3.12.1.4 Relevant Local Plans

The proposal extends through six counties, primarily within unincorporated land. However, it does fall within four city limits. The county and city jurisdictions are listed below from west to east:

- Snohomish County
- King County
- City of Snoqualmie
- City of North Bend
- Kittitas County
- City of Kittitas
- Grant County
- Adams County
- Franklin County
- City of Pasco

For each jurisdiction, the land use section of the ASC includes a description of the comprehensive plan, zoning ordinance, and Shoreline Management Master Program and subarea plans (if applicable), as well as relevant policies and land use designations from these documents.

3.12.2 Environmental Consequences

Land use impacts include effects on existing and future land uses on and adjacent to the pipeline corridor, pump stations, and associated facilities. This section also addresses the proposal's consistency with relevant federal, state, and local plans.

3.12.2.1 Proposed Petroleum Product Pipeline

Construction Impacts - Overall Proposal. The construction impacts on existing land uses would be minor except for recreational uses as discussed in Recreation. Most of the construction would occur in undeveloped, sparsely populated rural areas, along or adjacent to existing ROW (e.g., transmission lines, roadways, and trails) or previously disturbed areas. Exceptions are at the western end through Snohomish and King Counties, particularly at the beginning of the pipeline corridor near the Thrasher Pump Station and through the City of North Bend. The proposal would cross Ginkgo State Park, Wanapum Recreation Area, and Getty's Cove campground.

The construction corridor (which includes pipeline, pump station, terminal, and block valve construction) would be approximately 18 m (60 feet) wide along most of the pipeline corridor but would narrow to approximately 10 m (30 to 35 feet) where the pipeline is constructed on trails, park roads, or through residential and developed areas. Land uses that would be sensitive to construction activities include nearby residences, recreation areas, schools, and other sensitive land uses in developed areas.

Construction-related effects on land uses include increased noise, dust, and traffic; potential for inconvenient access; and temporary disturbance to the rural or open space character of some areas. These effects are addressed further in Sections 3.8 Air Quality, 3.9 Noise, 3.10 Traffic and Transportation, 3.13 Agriculture, 3.14 Recreation, and 3.15 Visual Quality and Aesthetics. This impact on land use is considered minor because construction-related effects would be temporary (physical construction activities at any one location typically last 2 weeks) and several measures would be implemented as part of construction to minimize effects on adjacent land uses.

Measures to minimize construction impacts would include limiting construction to daytime hours, using standard muffler systems on equipment, watering construction areas to reduce dust, and controlling construction by reducing the size of the construction corridor and maintaining access to land uses where the construction corridor narrows or is adjacent to public land uses and recreational trails. Construction would not result in changes to existing or future land uses.

Impacts from pipe staging areas and construction yards, which would be outside the construction corridor, would be limited to areas already disturbed and not adjacent to sensitive land uses or environmental features. Pipe would be delivered by train to the construction yards and trucked to the construction corridor.

Construction Impacts - Columbia River Approach Options. There would be no construction impacts to land use on the YTC from the preferred Ginkgo Petrified Forest State Park option because the YTC would not be crossed. Impacts to the Park are discussed in Recreation and would be major during construction.

Under the YTC options considered, construction impacts to the YTC would be minor to moderate (Figure 3.12-1). Military training activities occur as far north as I-90 and abut the I-90 boundary. Construction activities, including backfilling after the pipeline is in place at a minimum of 1.2 m (4 feet) below grade, could destabilize soils which could cause heavy vehicles (i.e., tanks) to sink when they "dig in and spin". Additionally, construction activities would compromise realistic training by placing artificial restrictions on training activities. If a YTC option were selected, all construction activities would be closely coordinated with the YTC to avoid conflicts between construction and training activities, and to limit future training activities over destabilized soils.

For the option south of and adjacent to I-90 (see Figure 3.12-1), the pipeline would be buried along or under a new gravel road north of the fence line. When the new road is adjacent to the fence, coordination for construction of the road and pipeline with YTC would help minimize impacts and may reduce the need for revegetation. In areas where the slope is too steep for the road, the new road would leave the fenceline and pipeline road and return to it where slopes are more suitable.

Construction Impacts - Columbia River Crossing Options. Construction impacts to land uses in the Columbia River vicinity would be similar for all alternate routes and would be minor. Primary land uses include undeveloped open space, rangeland, and agricultural land. The alternate routes would avoid the developed recreation areas, including the Ginkgo Petrified Forest State Park interpretive center, Wanapum Recreation Area, and Getty's Cove Campground and RV. The options closest to the Wanapum and Getty's Cove Campgrounds would avoid the developed facilities, primarily by staying within or adjacent to existing road ROW (i.e., Hunzinger Road and

Wanapum Road). All alternate routes would avoid the unincorporated communities around the river crossing, including Vantage on the west side, north of I-90, and Beverly and Wanapum Village on the east side, south of I-90.

Any construction-related effects on these nearby land uses would be temporary and mitigated by the measures being implemented as part of the proposal (described under "Construction Impacts - Overall Proposal" above).

Operational Impacts - Overall Proposal

Effects on Existing Land Uses. Effects on existing land uses would be minor. Most of the pipeline would be located in undeveloped rural land devoted to natural resource uses (forest and recreation) and agricultural uses (rangeland and crops). Where the pipeline corridor extends through developed areas, it is located in disturbed areas generally within or adjacent to transmission, trail, or road ROW. This includes the western end in Snohomish County where the Thrasher Pump Station and pipeline are entirely within an existing BPA transmission line ROW under electrical wires, and the portion extending through the Cities of Snoqualmie and North Bend where the pipeline is entirely within the existing Cedar Falls Trail ROW. The North Bend Pump Station is on undeveloped land adjacent to the corridor.

There would be minimal land use conversion. Existing forested areas would be cleared and the land converted to utility ROW because the corridor would need to remain visible for inspections. Potential effects from converting forested areas are addressed in the natural resource sections of this EIS (3.3 Botanical Resources, 3.5 Wildlife). Existing land uses could resume where the pipeline crosses recreation or agricultural uses because the pipeline would be at least 1 m (3 to 4 feet) deep, and because it would only extend through crops which can be replanted above the buried pipeline (i.e., avoiding orchards and asparagus fields). Structures would not be allowed on the ROW.

In some areas where portions of larger rural residential or industrial property would be acquired, the land is currently vacant or undeveloped, requiring little or no clearing. Potential loss in property value is addressed in Section 3.16, Socioeconomics.

The proposal would not require removal of any structures. All properties acquired for conversion (i.e., rural residential property) would be with the consent of the property owner[1]. Conditions of the ROW agreement would restrict the construction of buildings in the ROW.

Effects on Existing Adjacent Land Uses. Effects from pipeline operation on existing adjacent land uses and people would be negligible because the pipeline would be underground. Land use effects from operating the pump stations and Kittitas Terminal would be negligible to minor. Potential noise effects on wildlife are addressed in Section 3.5.

Potential impacts from the Thrasher, Stampede, and North Bend Pump Stations include increased noise and decreased visual quality for nearby residents (Thrasher and North Bend), as well

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[1] No property owners are known to be asked to give up a ROW via eminent domain.

as recreationists using the John Wayne Trail (Stampede) and Cedar Falls Trail (North Bend). These issues are addressed in Sections 3.9 Noise, 3.14 Recreation, and 3.15 Visual Quality and Aesthetics. The effects are considered minor because the pump stations would be enclosed and partially buffered by existing vegetation. Additionally, at the North Bend Pump Station, the Puget Sound Energy substation and Thrasher Road are situated between the pump station site and residents to the west. At the Stampede Pump Station, the area is already somewhat disturbed by the adjacent utility station and road/trail crossroads.

Land uses surrounding the Beverly-Burke and Othello Pump Stations are agricultural, and noise and visual effects would be negligible.

The Kittitas Terminal (pump station and storage/distribution facility) would have greater noise and visual effects because it would be a larger facility including truck loading activities. However, the effects are considered minor. Land uses surrounding the Kittitas Terminal are agricultural to the north, west, and east; I-90 freeway and interchange to the south; and highway commercial (two gas stations and cafe) to the immediate northwest. The nearest residence is 579 m (1,900 feet) northeast. The increased noise effects from the truck loading activities on the commercial uses and residence are addressed in Section 3.9, Noise, and the increased visual effects are addressed in Section 3.15, Visual Quality and Aesthetics. The Kittitas Terminal is not considered incompatible with the freeway interchange and commercial uses.

The area in the vicinity of the Kittitas Terminal is already in transition from agricultural to commercial and industrial, as the City of Kittitas expands south toward the freeway. The pump station site and land to the north are within the city's UGA and are being rezoned from agriculture to general industrial. The traffic on I-90 is an existing dominant noise generator. A vegetative buffer zone would be placed along the terminal boundaries to reduce noise and minimize visual effects.

Effects on Future Land Uses. Future land uses directly above the pipeline may be restricted to exclude certain development, some agricultural production (orchards), structures, or other activities that could involve excavation or disturbance of the pipeline. These effects are considered minor because most of the pipeline is in already disturbed areas within or adjacent to existing ROW where future development is already limited and because most uses of the ROW will be allowed. In addition, all property owners (including residential property owners) to date are providing their consent. Effects on future agricultural production are addressed in Section 3.13, Agriculture.

Future land uses on and adjacent to pump stations may be restricted due to noise generated by the pump stations and truck loading activities at the Kittitas Terminal. These effects are considered minor for reasons described below.

Thrasher Pump Station. At the Thrasher Pump Station, future development onsite is already restricted because it is within an existing BPA ROW. Future development offsite is already restricted by the existing zoning (suburban agriculture, 0.4 ha or 1 acre) and existing suburban/rural residences. Most of the area appears cleared and built out, although there is still relatively dense forest to the west. Potential noise effects on future residences would be minor

because the pump station would be enclosed. Additionally, the low-density zoning restricts development and provides opportunities to construct residences further away from the pump station.

North Bend Pump Station. The North Bend Pump Station site and adjacent land to the northwest are unincorporated and zoned by the county as regional business. This undeveloped land is within the city's UGA and shown on city maps as low-density residential (formerly general commercial).

The effects of the pump station on future development of this adjacent land for business or commercial uses would be minor, because the land is already surrounded by the Puget Sound Energy substation to the northwest, USFS ranger station to the south, and Cedar Falls Trail to the north. In addition, the pump station would be situated on the east side of the site, maintaining access to Thrasher Road. The pump station would be enclosed to minimize noise.

The effects of the pump station on future low-density residential development (as identified by the city for this unincorporated area) of adjacent land would be moderate. Adjacent land is already bounded by the power substation to the northwest and USFS station to the south; the pump station and access road would further "enclose" such residential development, rather than allowing a transition from low-density residential to the multifamily residences that may be constructed in the future to the southeast. This could also lower the property value of future low-density development in this area.

However, the loss of 0.6 ha (1.5 acres) for either low-density residential or commercial development would be minor because there are other areas within the city's UGA with these designations. The property owners of the adjacent land to the northwest support the regional business designation but oppose the residential designation of their property. (Smith pers. comm.)

The undeveloped land adjacent to the North Bend Pump Station on the southeast side is within the city limits and is currently the last undeveloped land zoned multifamily residential within the city limits (Smith pers. comm.). The effects of the pump station on development potential of this property would be minor because the pump station would be enclosed, minimizing noise effects. Maintaining the existing vegetative buffer or establishing a new one would minimize visual effects.

Stampede Pump Station. The Stampede Pump Station site is located where Stampede Pass Road bisects the John Wayne Trail in Kittitas County. The site is on private property owned by OPL. County zoning is for commercial forest, which also restricts future use and development for private property. This zoning permits "utility substations" as a conditional use. The pump station would be enclosed to protect the equipment from winter weather, which would minimize noise effects on continued recreational use of the adjacent John Wayne Trail.

Kittitas Terminal. At the Kittitas Terminal (pump station and storage/ distribution facility), the unincorporated lands onsite and adjacent to the north and east are zoned agriculture. Effects on future land uses would be negligible because future development on the site and to the north and east is already restricted by the agricultural zoning and to the south by the existing freeway. Agricultural use of the site would be eliminated by the terminal.

The adjacent property to the west, including that occupied by the two gas stations and cafe, is in the City of Kittitas. The city is trying to incorporate the terminal site and has designated it general industrial within the city's UGA. The county has accepted this designation and will consider this revision as part of their comprehensive plan amendments. After the comprehensive plan is revised, a request would be submitted to rezone the site from agriculture to general industrial. Effects with and without the rezone are considered minor because the terminal would be compatible with either agricultural or industrial use.

Effects on future land uses to the west would be minor. The area is already dominated by highway noise, and a vegetation buffer would be planted on the perimeter to reduce visual and noise effects. Future land uses in the general industrial and highway commercial zones would not likely be altered as a result of this proposal. Effects on agricultural use are also addressed in Section 3.13, Agriculture.

Beverly-Burke and Othello Pump Stations. At the Beverly-Burke and Othello Pump Station sites, effects on future land uses are considered negligible because future development onsite and adjacent to the site is already restricted by the agricultural zoning, and there are no nearby residential land uses. Effects on agricultural use are addressed in Section 3.13, Agriculture.

Consistency with Relevant Federal and State Plans and Guidelines. The proposal was evaluated for consistency with relevant federal and state plans and authorities, which provide direction on management of federal and state lands through which it extends. These lands are managed by a number of agencies, including the USFS, BLM, U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service, Washington Department of Fish and Wildlife, Washington State Parks and Recreation, and Bonneville Power Administration. Not all of the plans have been formally adopted by the respective agencies. Nevertheless, as part of the proposal, OPL would coordinate with these agencies during project planning and prior to construction to minimize potential environmental effects, mitigate the general disruption caused by construction activities, and ensure compliance with the intent of these plans and relevant regulations.

At this stage in project planning, a "Consistent" determination is given if the proposal is determined to be consistent or not inconsistent, or if the plan is silent regarding petroleum pipelines or utility lines. "Inconsistent" determinations are given if the proposal was not consistent with any part of any standards and guidelines of the plans being evaluated.

The current proposal is inconsistent with the Mt. Baker-Snoqualmie National Forest Land and Resource Management Plan (MBSLRMP) as amended by the NFP. The proposal is not inconsistent with most other adopted federal and state plans (Table 3.12-2). However, consistency in most cases depends on ongoing coordination with agency staff and may depend on mitigation identified in the natural resources analyses (Sections 3.2 Geology, Soils, and Seismicity; 3.3 Botanical Resources; 3.4 Wetlands; 3.5 Wildlife; 3.6 Water; and 3.7 Fisheries). The discussion below describes the justifications behind these determinations.

Mt. Baker-Snoqualmie National Forest Land and Resource Management Plan. The current project proposal would require removing standing second-growth

trees (largest diameters are approximately 36 cm [14 inches]) on lands designated as Late-Successional Reserves (LSR) adjacent to the Humpback Creek crossing (crossing 78 on ASC map atlas page 23). Though the trees and the stand are not considered old-growth, the Standards and Guidelines (S&Gs) in the Record of Decision (ROD, page C-17) for the NFP state that new developments in an LSR will be located to avoid degradation of habitat and adverse effects on identified late-successional species (USFS/BLM 1994) .

The project may possibly be inconsistent with other S&Gs as well. The ASC does not provide enough specific information to evaluate the consistency of stream crossing construction methods within Riparian Reserves, and does not completely consider site-specific findings and recommendations detailed in USFS watershed analyses (South Fork Snoqualmie River; Upper Yakima River) as directed by the NFP (Mt. Baker-Snoqualmie National Forest 1995, Wenatchee National Forest 1997).

An "Inconsistent" determination at this stage in the planning process does not necessarily indicate that the project is prohibited on USFS or BLM lands, nor is it even prohibited at a site like Humpback Creek. The ROD provides for approval of new developments like a pipeline when they are reviewed and approved on a case-by-case basis. As with other federal and state plans mentioned above, consistency may depend on coordination with agency staff and on avoidance or mitigation measures identified in the natural resources analyses. A review of the project will be made by USFS and BLM decisionmakers and included in the Final EIS. The ROD, signed and effective with the publication of the Final EIS for this project, will record the consistency determination.

Other Plans. The National Environmental Policy Act (NEPA), Washington State Environmental Policy Act (SEPA), State of Washington Growth Management Act (GMA), and the State of Washington Shorelines Management Act are satisfied either through this EIS or through local plans as identified in Table 3.12-2.

The Bureau of Reclamation's Yakima and Columbia Basin Projects, and the Columbia River Basin Ecosystem Management Project and the Eastside Plans under development by the USFS and BLM, have no formally adopted planning documents. In these cases, consistency with agency plans is not applicable or is not required. However, OPL would coordinate with agency staff to minimize potential impacts of the project on riparian habitat and other natural resources protected by agency S&Gs (Table 3.12-2).

The proposed pipeline would cross Columbia National Wildlife Refuge lands adjacent to Highway 26 between MP 173 and MP 174 and at MP 182 managed by the U.S. Fish and Wildlife Service (USFWS). Although consistency of the proposal with the Refuge's Manual and management authority is anticipated, OPL will need to present a thorough mitigation and monitoring plan to demonstrate the project has fully compensated for unavoidable impacts. Consultations with the USFWS will also be required to determine whether the proposal adversely modifies habitat critical to threatened, endangered, and special-status species (Table 3.12-2).

Table 3.12-2. Evaluation of Proposal's Consistency with Relevant Federal and State Plans

Relevant Plan (Agency)	Draft Consistency/ Determination	Evaluation/Comments and Guidelines
Mt. Baker-Snoqualmie National Forest Land and Resource Management Plan (USFS)	Inconsistent	Plan is amended by the Northwest Forest Plan (NFP) and adopts the Alpine Lakes Area Land Management Plan in whole. Not inconsistent as evaluated against goals of relevant land use classifications and policies on private use of lands and on siting utility corridors. Although NFP standards and guidelines (S&Gs) allow utility uses on USFS/BLM lands, the proposal is inconsistent as it would harvest trees in late-successional reserves near Humpback Creek. Proposal may also be inconsistent with other riparian standards and guidelines.
Wenatchee National Forest Land and Resource Management Plan (USFS)	Consistent	Plan is amended by the NFP. No specific policies on petroleum pipelines, but S&Gs allow utility uses on forest land. Not inconsistent as evaluated against goals of relevant land use classifications and policies on special use management and siting utility corridors.
Snoqualmie Pass Adaptive Management Area Plan (USFS/USFWS)	Consistent	Plan is an offshoot of the NFP. Not inconsistent (i.e.,. it is neutral or beneficial) with objectives for late-successional forest and riparian reserves within the adaptive management area.
Bureau of Land Management (BLM) Spokane District Resource Management Plan	Consistent	Plan is amended by the NFP. No inconsistencies evaluated against policy for utility and/or transportation corridors.
Bonneville Power Administration Standards and Regulations (BPA)	Consistent	Allows joint use of BPA transmission ROW for pipeline installation within established regulations.
Columbia River Basin Ecosystem Management Project - Eastside Plan (USFS/BLM)	N/A	Currently (1998) no formal planning document adopted. Coordination with USFS/BLM staff would minimize potential impacts concerning the protection of riparian habitat and other relevant USFS/BLM standards and objectives.
Yakima and Columbia Basin Projects (BOR)	N/A	Currently (1998) no formal planning document adopted. Coordination with BOR staff would minimize potential conflicts with relevant BOR standards and guidelines.
Columbia National Wildlife Refuge (USFWS)	Consistent	OPL would coordinate with USFWS staff. Consistency dependent on OPL mitigation plan and TES consultations.
National Environmental Policy Act (NEPA) and Washington State Environmental Policy Act (SEPA)	Consistent	This EIS is being prepared as a joint NEPA/SEPA document under the USFS, federal lead agency, and Washington Energy Facility Site Evaluation Council (EFSEC), state lead agency.
State of Washington Growth Management Act (GMA)	Varies	Snohomish, King, Kittitas, Grant, and Franklin Counties and Cities of Snoqualmie, North Bend, Kittitas, and Pasco are required to prepare comprehensive plans in compliance with the GMA (refer to Table 3.12-3).
State of Washington Shoreline Management Act	Consistent	Addressed under local plans (refer to Table 3.12-3).

Note: "Consistent" determination was given if the proposal was determined consistent or not inconsistent, or if the plan was silent regarding petroleum pipelines or utility lines. OPL coordination with the relevant agencies during project planning and prior to construction to minimize potential environmental effects and mitigate the general disruption caused by construction activities supports a "consistent" determination. "Inconsistent" was given if the proposal was not consistent with any of the standards and guidelines being evaluated.

The MBSLRMP, in addition to being amended by the NFP, adopted in whole the Alpine Lakes Area Land Management Plan. Similar to the MBSLRMP, the Wenatchee National Forest Land and Resource Management Plan is also amended by the NFP. A third plan, the Snoqualmie Pass Adaptive Management Area Plan, governs USFS checkerboard lands east of the Cascade Crest near Snoqualmie Pass, with a decision to manage them primarily as Late-Successional Reserves (LSR). As the proposal would stay primarily in established ROWs and would not harvest trees in these areas, consistency with these plans is anticipated. However, as described under the NFP above, a consistency determination is dependent on a case-specific review and approval to be executed in the ROD after the Final EIS (Table 3.12-2).

The Spokane District Resource Management Plan governs all BLM lands in Washington State. As evaluated against its policy for utility and transportation corridors, the proposal is believed to be not inconsistent with BLM direction. Similarly, a review of BPA standards and regulations indicates joint use of BPA transmission ROWs for pipeline installation is permissible in the segments identified in the proposal. OPL would coordinate with these agencies to maintain consistency with these guidelines (Table 3.12-2).

In addition to the above plans, OPL must submit and comply with a construction/operation maintenance plan (Plan of Development). This plan describes activities on all federal lands and the mitigation required by federal agencies managing those lands.

Consistency with Relevant Local Plans. The proposal's consistency with relevant local plans (including the zoning code, comprehensive plan, and shoreline master plan) was evaluated for the six counties and four cities through which the proposal extends. The evaluation is summarized in Table 3.12-3, with additional information provided in the land use section of the ASC.

The proposal is considered consistent with the relevant local plans in all jurisdictions, except Kittitas County and Grant County as described below. This impact is considered minor because, in most cases, petroleum pipelines and associated facilities are not specifically addressed in the plans, yet similar uses are allowed, and because administrative processes are already being implemented with the local agencies to resolve potential inconsistencies. These processes would likely be completed before the end of the environmental review process.

Kittitas County. The proposal (in its entirety) would be inconsistent with the zoning code or comprehensive plan, but would be a permitted use in the Shoreline Master Program. In the zoning code, petroleum pipelines are not listed as permitted or specified as a conditional use. A prohibited use is defined as a use not specifically permitted. However, the zoning code allows for overriding determinations by the county zoning administrator (planning director), whereby property owners are notified and appeals are forwarded to the County Board of Adjustment for final determination.

A zoning code text amendment to bring the pipeline component of the proposal into compliance with current zoning regulations has been approved in draft form by county commissioners and is expected to be adopted in 1998. The text amendment would allow Special Utilities (pipeline and pump stations) and Associated Facilities (terminal or storage/distribution facility) as a conditional use.

Table 3.12-3 Proposal's Consistency with Relevant Local Plans

Relevant Plan	Consistency Determination[1]	Evaluation/Comments
Snohomish County *(Thrasher Pump Station, pipeline)*	Consistent	**Zoning Code:** Permitted use in all zoning designations. **Comprehensive Plan:** No specific policies on petroleum pipelines or pump stations (evaluated with general guidelines on siting of private utility systems). **Shoreline Master Plan:** Permitted use.
King County *(pipeline)*	Consistent	**Zoning Code:** Permitted use in all zoning designations. **Comprehensive Plan:** No specific policies on petroleum pipelines or pump stations (evaluated against policies for facilities and services, energy and telecommunications). **Shoreline Master Plan:** Permitted use.
City of Snoqualmie *(pipeline)*	Consistent	**Zoning Code:** Permitted use in all zoning designations. **Comprehensive Plan:** No specific policies on petroleum pipelines or pump stations (evaluated against policies in land use, parks and recreation, and utilities elements). **Shoreline Master Plan:** Permitted as conditional use.
City of North Bend *(pipeline, North Bend Pump Station)*	Consistent	**Zoning Code:** Permitted use in all zoning designations pursuant to conditional use criteria. **Comprehensive Plan:** No specific policies on petroleum pipelines or pump stations (evaluated against policies in utilities element). **Shoreline Master Plan:** Permitted as conditional use.
Kittitas County *(pipeline, Stampede Pump Station, Kittitas Terminal)*	Inconsistent[2]	**Zoning Code:** Petroleum pipelines are not listed as a permitted or conditional use in the zoning code. Stampede Pump Station allowed in commercial forest zone. Kittitas Terminal not allowed in current agricultural zone (but would be permitted as a conditional use in the proposed general industrial zone). **Comprehensive Plan:** No specific policies on petroleum pipelines or pump stations, and no regulations on the hazardous liquid pipelines addressed in the utilities element. Pump station and pipeline (evaluated as essential public facilities) would be consistent with land use and utility policies. Terminal (evaluated as a new industrial development) would be consistent with utility policies but <u>not</u> with agricultural policies (agricultural policies would not apply if terminal site is rezoned industrial). **Shoreline Master Plan:** Permitted use.
City of Kittitas *(pipeline)*	Consistent	**Zoning:** Permitted pursuant to conditional use criteria. **Comprehensive Plan:** Adopted June 1997, it does not specifically address petroleum pipelines. **Shoreline Master Plan:** Not applicable.

Table 3.12-3. Continued

Relevant Plan	Consistency Determination[1]	Evaluation/Comments
Grant County *(pipeline, Beverly-Burke Pump Station)*	Inconsistent[3]	**Zoning:** Petroleum pipelines and pump stations are not specifically listed as permitted uses, but similar uses are permitted in some of the zones.[3] **Comprehensive Plan:** Being updated. Determined consistent with the utilities and energy policies according to county staff. **Shoreline Master Plan:** Permitted as conditional use.
Adams County *(pipeline, Othello Pump Station)*	Consistent	**Zoning Code:** Does not include a definition of a pipeline, utility or transmission line. County indicated they would consider the proposal under "unclassified uses" and permit it like a conditional use. **Comprehensive Plan:** Being updated. County uses zoning code for land use determinations. **Shoreline Master Plan:** Not applicable.
Franklin County *(pipeline)*	Consistent	**Zoning Code:** Petroleum pipelines not specifically listed. County indicated pipelines considered transmission lines, which are permitted as a conditional use in all zones. **Comprehensive Plan:** No specific policies regarding petroleum pipelines (evaluated against utilities element). **Shoreline Master Plan:** Permitted as conditional use.
City of Pasco *(pipeline)*	Consistent	**Zoning Code:** Petroleum pipelines not specifically listed in the zoning designations (silent). **Comprehensive Plan:** No specific policies regarding petroleum pipelines (silent). **Shoreline Master Plan:** Not applicable.

Source: This information was developed based on review of the relevant plans and coordination with local planning staff. Detailed discussion of the relevant plans and rationale for consistency determination are in the ASC land use section.

1 "Consistent" determination was given if the proposal was determined consistent or not inconsistent, or if the plan was silent regarding petroleum pipelines or utility lines. "Inconsistent" was given if the proposal was not consistent with any one of the plans being evaluated.

2 Uses not specifically permitted are considered prohibited. However, the Zoning Administrator makes the determination to allow the use. The terminal site is unincorporated land within the City of Kittitas Urban Growth Area (UGA) and designated in the city comprehensive plan as general industrial. Kittitas County currently zones this area as agricultural, but is expected to adopt the Kittitas UGA and amend their comprehensive plan to general industrial. A rezone would be requested, and this rezone would allow Special Utilities (pipeline and pump station) and Associated Facilities (terminal) as a conditional use, and would deem the agricultural policies in the comprehensive plan inapplicable.

3 Public utilities are permitted as a conditional use in agricultural zone, but are not specifically listed as a permitted use for industrial or open space zones. However, certain uses for public necessity/convenience may be permitted upon approval by the County Board of Adjustment (i.e., petroleum bulk plants, storage, and refining facilities are permitted in industrial zone). A request for special permits or text amendments has been submitted.

The Stampede Pump Station (considered a "utility substation") would be permitted as a conditional use in the commercial forest zone.

The Kittitas Terminal (pump station and storage/distribution facility) is proposed for a site currently zoned Agricultural-20. The Kittitas Terminal is inconsistent with the zoning code and would not be a permitted use in the Agricultural-20 zone. The pump station component (considered a utility substation) would be permitted in this zone pursuant to conditional use criteria, but the terminal is not listed as a permitted or conditional use and, therefore, is considered prohibited. However, this site is on unincorporated land within the City of Kittitas UGA and designated in the city comprehensive plan as general industrial. Once Kittitas County has adopted the Kittitas UGA (expected in 1998), amended the county's comprehensive plan to be consistent with the city's, and finalized the proposed zoning text amendment, a rezone to general industrial would be made which would allow the terminal as a conditional use.

The comprehensive plan does not include specific policies on petroleum pipelines, pump stations, or terminal facilities. Hazardous liquid pipelines are addressed in the utilities element, but there are no regulations. When evaluated as essential public facilities, the pump station and pipeline are considered consistent with the land use and utility policies. When evaluated as a new industrial development, the terminal would be considered consistent with utility policies, but not with the agricultural policies. However, if the terminal site is rezoned general industrial as anticipated, the agricultural policies would not apply and the terminal would be considered consistent.

Therefore, the proposal is considered inconsistent with the zoning code and comprehensive plan unless the Kittitas Terminal site is rezoned general industrial and the zoning code is amended to specify petroleum pipelines as an allowed use or permitted conditional use.

Grant County. The proposal (pipeline and Beverly-Burke Pump Station) is not considered consistent with the zoning code, but is considered consistent with the comprehensive plan and would be permitted as a conditional use in the Shoreline Master Program. The comprehensive plan is being updated (the prior comprehensive plan was written in 1966 and is outdated). The county has indicated that the pipeline is consistent and in compliance with the comprehensive plan goals relative to utilities and energy (Lambro pers. comm.).

In the zoning code, petroleum pipelines and pump stations are not specifically listed as permitted uses, but similar uses are permitted in some of the zones. The pipeline crosses the agriculture, light industrial, heavy industrial, and open space recreation zones; and the Beverly-Burke Pump Station is in the agriculture zone. Although not specifically listed as permitted uses in the agriculture zone, the pipeline and pump station could be considered utility functions and would therefore be a permitted use in the agriculture zone. Although petroleum pipelines are not specifically listed as a permitted use in the industrial zones, permitted uses include fuel oil distributor (retail), petroleum bulk plants, and petroleum storage and/or refining facilities. A petroleum products pipeline is not listed as a permitted use in the open space recreation zone.

By definition, prohibited uses are those uses not specifically enumerated as permitted uses. The county is currently processing a request for a special permit which allows unclassified uses or a zoning code amendment to specifically permit utility lines either outright or by conditional use in all

zones. Because the county determined the pipeline consistent with the comprehensive plan, a zoning code text amendment may be appropriate to specifically permit utility and energy transmission lines either outright or by conditional use in all zones.

Operational Impacts - Columbia River Approach Options. For the proposed route through Ginkgo State Park, the pipeline would be periodically inspected via driving/walking surveys. The pipeline would be clearly marked, as discussed in Chapter 2. No land use impacts are anticipated for this proposed route.

Operational impacts on the YTC would be minor to moderate for options that would be located in existing northern expansion training areas (Figure 3.12-1). Because installation of the pipeline would destabilize the soil on the affected areas, training activities involving heavy equipment (i.e., tanks) that "dig in and spin" would be at risk of sinking (particularly in winter and spring when the soils are softer from rain) and possibly rupturing the pipeline. Markers to identify pipeline location would be installed but may be difficult to see during night training. This impact is considered minor because if such an option were selected, OPL would coordinate with the YTC to ensure adequate markers are installed so the pipeline location can be identified even at night and avoided by heavy equipment.

Additionally, training activities as a whole would be compromised by placing additional artificial restrictions (not relevant in a real combat situation) in the northern expansion area (see "Conflicts with the YTC" label on Figure 3.12-1). The purpose of acquiring the northern expansion area was to provide training opportunities that are relatively free of constraints, particularly the historical and natural resource constraints at the historical YTC. Although an alternative route in this area would only directly affect 1 to 2 percent of the northern expansion area, it would negatively affect 20 percent of the area used for training with heavy equipment by placing additional administrative and tactical restraints (Krueger pers. comm.). Other artificial constraints at the YTC that restrict training activities include I-90, farms in Badger Pocket, John Wayne Trail, Ginkgo State Park, Saddle Mountains, and other normal environmental constraints (i.e., avoiding creeks). The impact of adding another artificial restriction to training activities is considered moderate. Although it would not jeopardize national security, it would conflict with the intent of acquiring the northern expansion area, and it is not feasible to use other areas on the YTC or acquire land outside the YTC for similar training activities.

For the option south of and adjacent to I-90 there would be a beneficial effect for YTC (see "Benefits YTC" label on Figure 3.12-1). As part of this option, a gravel road would be installed above the pipeline rather than revegetating the corridor, which would provide fire control for YTC.

Operational Impacts - Columbia River Crossing Options. Operational impacts on the land uses near the Columbia River vicinity would be minor or negligible for reasons similar to those described under "Construction Impacts - Columbia River Crossing Options". There are no above-ground facilities proposed in this area. Existing land uses could continue to operate, would not be affected by the pipeline, and would not disrupt pipeline operation. Future land uses in this area are restricted by the existing state park ownership, as well as BLM and Bureau of Reclamation.

Cumulative Impacts. Cumulative impacts on land use are considered minor. There are potential cumulative effects on training activities at the Yakima Training Center if an option to cross the YTC were selected. The pipeline would place additional artificial restrictions, primarily on training maneuvers and simulation involving heavy vehicles, on a substantial portion of the northern expansion training area, which was acquired for its lack of restrictions. There are no lands available elsewhere on YTC due to existing restrictions, and acquiring additional land for training is difficult and unlikely.

Additionally, there could be a cumulative effect at the Kittitas Terminal from adding another non-agricultural land use to and are transitioning from agriculture to commercial and industrial land uses. This is considered minor because the site is within the City of Kittitas urban growth area which designates the site and land to the north and west for non-agricultural uses, and the area has been in transition as the City of Kittitas expands south to I-90. Cumulative effects on other land uses are negligible.

3.12.2.2 No Action

Under the No Action Alternative, no new pipeline and associated facilities would be constructed. In general, there would be no effects to existing or planned land uses and no inconsistencies with relevant plans and policies. Under No Action, the number of barges and trucks would likely double over the next 30 years. This may increase the demand for supporting facilities in ports and along the highway (i.e., gas stations, mini-marts, rest stops). The land use effect of developing such facilities is considered minor.

3.12.3 Additional Proposed Mitigation Measures

No additional mitigation measures, beyond those included as part of the project by the applicant, are proposed.

3.13 AGRICULTURE

3.13.1 Affected Environment

3.13.1.1 Pipeline

Large sections of the pipeline would cross lands used or suitable for agricultural use, particularly in eastern Washington. For each of the six counties through which the pipeline corridor extends, Table 3.13-1 identifies the amount of pipeline crossing land that is zoned agriculture, describes the current agricultural use, and identifies crops grown near the pipeline corridor and the amount of prime farmland affected. Specific information on the location of agricultural land and on the soil types is included in the ASC land and shoreline use section (OPL 1998).

The pipeline would cross through areas where a wide variety of crops are grown, particularly in eastern Washington where large stretches of the pipeline corridor run adjacent to agricultural crop fields. Approximately 40 percent of the pipeline corridor extends through active agriculture or crop lands. Dryland crops (only 10 percent irrigated) that would be affected include wheat, barley, oats, hay, and dry beans. Partially irrigated crops (50 percent dryland) that could be affected include hay. Irrigated crops that would be affected include corn, peppermint, spearmint, potatoes, asparagus, carrots, apples, apricots, and pears. Crop type at any one location is highly variable, ranging from one to three crops per year, occasionally in fallow, and rarely the same crop each year. Therefore, it is impossible to identify the actual crops and precise value of produce affected by construction in any future year. Additional information, including the average crop value per acre, is included in the ASC.

Specific irrigation methods used in the field (i.e., circular irrigation, fixed pipe, and flood) vary widely depending on soil properties, topography, and cost. Some fields also have drain tiles beneath the soil to enhance subsurface drainage.

Several miles of the pipeline corridor traverse livestock pasture and grazing areas, especially in eastern Washington. Livestock include cattle, sheep, and horses.

3.13.1.2 Pump Stations

The Kittitas Terminal (pump station and storage/distribution facility), Beverly-Burke Pump Station, and Othello Pump Station sites are currently zoned agriculture. The other pump station sites (Thrasher, North Bend, and Stampede) are not currently zoned for or in agricultural use.

The Kittitas Terminal site (10.9 ha or 27 acres in Kittitas County) is irrigated agricultural land currently producing timothy hay. The Beverly-Burke Pump Station site (0.8 ha or 2 acres in Grant County) is vacant and not currently in agricultural use, although there are cultivated land and mechanical irrigation circles to the south. The Othello Pump Station site (1 ha or 2.5 acres in Adams

Table 3.13-1 Description of Agricultural Land Potentially Affected by Pipeline Project

County	Portion of Pipeline Crossing Lands Zoned for Agricultural Use or in Current Agricultural Use	Identified Crops Grown Near Pipeline[a]	Amount of Cropland Potentially Impacted[b]	% of Total Cropland in County[c]
Snohomish	*Portion Zoned Agriculture:* 1.6 kilometers (1 mile)[d] *Current Use:* Most used as pasture land for dairy cattle or for grass fodder production.	Hay	3.1 hectares (7.6 acres)	0.04
King	*Portion Zoned Agriculture:* None[e] *Current Use:* Most used as pasture land for dairy cattle or for grass fodder production.	Hay	1.5 hectares (3.6 acres)	0.07
Kittitas	*Portion Zoned Agriculture:* 53 kilometers (33 miles)[d] *Current Use:* Most used as livestock grazing/rangelands. Some irrigated and non-irrigated croplands.	Corn, potatoes, wheat, barley, oats, hay	26.5 hectares (65.5 acres)	0.12
Grant	*Portion Zoned Agriculture:* 48 kilometers (30 miles)[e] *Current Use:* Most used for irrigated and non-irrigated croplands. Some livestock grazing and orchard areas.	Potatoes, beans, asparagus, mint, wheat, barley, oats, corn, hay	95.1 hectares (234.9 acres)	0.05
Adams	*Portion Zoned Agriculture:* 14.5 kilometers (9 miles) (all of pipeline) *Current Use:* Most used for irrigated and non-irrigated croplands. Some used for livestock grazing/rangelands and orchard areas.	Wheat, oats, barley, corn, potatoes, beans, hay	25.6 hectares (63.3 acres)	0.01
Franklin	*Portion Zoned Agriculture:* 66 kilometers (41 miles) (nearly all of pipeline)[d] *Current Use:* Used for irrigated and non-irrigated croplands, orchard areas, and livestock grazing/rangelands.	Wheat, oats, barley, hay, potatoes, beans, corn, carrots, asparagus, apples	121.8 hectares (301 acres)	0.11

[a] Hay includes alfalfa and various grasses grown for fodder.

[b] Assumes worst-case impact of 18 m (60-foot) wide construction corridor (pipeline and pump stations) and assumes all the "agricultural land" is productive cropland. All currently productive agricultural land would be able to resume production after construction, with some restrictions on future uses over the pipeline (i.e., restricted excavating activities, no orchards). Exceptions are the Kittitas Terminal site (10.9 ha [27 acres]) in Kittitas County and the Othello Pump Station site (0.6 ha [1.5 acres]) in Adams County.

[c] Percentage of total identified cropland in the county potentially impacted by the proposal. County cropland totals are based on 6-year averages (1989-1994) of the total cropland area in production in the county, obtained from the Washington Department of Agriculture (refer to the land and shoreline use discussion in the ASC).

[d] Agricultural uses are allowed in all other zones crossed by the pipeline.

[e] Agricultural uses are allowed in most other zones crossed by the pipeline.

County) is partially in agricultural use, with 0.6 ha (1.5 acres) irrigated and planted with alfalfa and 0.4 ha (1 acre) not irrigated and used to store farm equipment. Adjacent uses include an irrigation pond and orchards.

3.13.1.3 Farmland Protection Act and Prime Farmland

Section 1539 of the Farmland Protection Act, Public Law 97-98 (December 22, 1981), was established to minimize federal actions that result in unnecessary and irreversible conversion of farmland to non-agricultural purposes. Under the Act, federal agencies must examine their actions for potential adverse effects on farmlands, as determined by applying the criteria established for federal rules (7 CFR 658.4). Section 658.4(a) states that the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) (formerly the Soil Conservation Service) may make the determination. The Washington Department of Agriculture uses the NRCS definition of prime farmland (Lang pers. comm.).

The NRCS maintains a map inventory of the prime farmland in the United States. Although there are several specific considerations, prime farmland is defined as having the best combination of soil properties, growing season, and moisture supply needed to produce sustained yields of crops in an economic manner, as determined by soil scientists. Although it is NRCS policy to maintain a current inventory of prime farmland and unique farmland, it is the responsibility of appropriate local and state officials to evaluate prime farmland on a case-by-case basis. (Natsuhara pers. comm.)

There are approximately 133.5 ha (330 acres) of soils meeting NRCS criteria for prime farmland within the 18 m (60-foot) construction corridor for the pipeline and pump stations. The NRCS provided a list of soil types, criteria for prime farmland, and a list of what was considered prime farmland in each county. Individual counties provided maps with soil types within the 18 m (60-foot) construction corridor. Because prime farmland is based on soil types, it is not necessarily in agricultural use. Following is the prime farmland acreage along the construction corridor for each county:

- 37 ha or 91 acres (Snohomish County)
- 16 ha or 39 acres (King County)
- 32 ha or 80 acres (Kittitas County)
- 16.6 ha or 41 acres (Grant County)
- 7 ha or 17 acres (Adams County)
- 25 ha or 62 acres (Franklin County)

Of the six pump station sites, the Thrasher, North Bend, Kittitas, and Othello sites have soils considered prime farmland. However, only the Kittitas Terminal site and Othello Pump Station site are in agricultural production.

3.13.2 Environmental Consequences

This section addresses the amount of crops/cropland potentially affected by the proposal, including prime agricultural land, and effects on livestock and irrigation facilities. Potential impacts from noxious weeds being introduced from construction vehicles are addressed in Section 3.3, Botanical Resources, and the economic impacts of landowner easements are addressed in Section 3.16, Socioeconomics.

3.13.2.1 Proposed Petroleum Product Pipeline

Construction Impacts - Overall Proposal

Croplands and Crops. Although approximately 50 percent (183.5 km or 114 miles) of the 18 m (60-foot) wide construction corridor extends through croplands, it is estimated that less than 10 percent (likely less than 5 percent) of the croplands would be temporarily affected by construction activities. This is because the proposed pipeline was routed at the edge of fields or property lines. Construction of the overall proposal would avoid removing orchards or other crops, such as asparagus, that would have long-term impacts (i.e., asparagus requires 2 to 3 years for production). However, the proposal extends adjacent to fruit orchards in Grant and Franklin Counties. Orchards not only take several years to replace and have a higher compensation cost, but would interfere with aerial visual inspection and have potential for tree root growth around the pipeline. Additionally, construction would be timed to avoid hay and grass fields during the growing season to the extent practicable; however, if it cannot be avoided, payment for easements would also include the expected crop value lost.

The amount of croplands potentially affected by the proposal (from the pipeline and pump stations) is summarized in Table 3.13-1. In all six counties, impacts to croplands would account for less than 0.2 percent of the total county croplands typically planted with crops along the pipeline corridor.

Along the pipeline corridor, construction activities could disrupt a portion of the planting, growing, and/or harvesting of crops. Additionally, there could be partial loss of productivity of croplands directly adjacent to construction activities due to compaction of soil by construction equipment and removal of crops and topsoil for ROW and staging area preparation. The efficiency and productivity of farming activities could also be reduced from disrupted access across the ROW to adjoining cropland parcels.

These impacts are considered minor because of the short, temporary duration of construction activities and the small area of cropland affected. Construction through agricultural areas is expected to occur at a rate of 2.7 to 4.0 km (1.7 to 2.5 miles) per day, with the active construction zone at any one location limited to approximately 10 days. Equipment cleaning and washing procedures would be implemented to prevent the spread of noxious weeds.

Following construction, agricultural lands would be restored to their pre-existing soil types and graded levels; compacted soil would be loosened by tilling after pipeline is installed and backfilled; and most agricultural activities would be able to resume over the top of the pipeline. Additionally, there would be coordination with property owners/farmers to ensure construction activities would occur outside the planting, growing, and harvesting period wherever feasible; and farmers would be compensated for crop removal and/or damage or lost productivity caused by construction activities. Recovery would occur in agricultural areas with returned top soil, although returned productivity can occur from 1 to 3 years if the soil layer is changed.

There would be a permanent loss of productive agricultural land at the Kittitas Terminal and Othello Pump Station sites. Refer to "Operational Impacts - Overall Proposal" below.

Livestock. Although the proposal would avoid all commercial livestock corrals, it would cross through several miles of livestock pasture and grazing areas. In these areas, fencing and gates would be removed to provide construction vehicle access. This could restrict livestock to other fenced areas, reduce the amount of land available for grazing, and disrupt livestock access to supplementary feeding and watering stations for up to 3 hours during the construction period. Construction activities could also result in small losses of pasture and grazing lands available for forage as vegetation is removed and soil is disturbed and compacted.

These impacts are considered minor. Impacts would be temporary, and construction activities would be coordinated with farmers to ensure livestock access to feeding and watering stations and farm equipment access across the ROW. After construction, fences and gates that were removed would be replaced, and native vegetation (or other vegetation upon landowner request) would be replanted.

For ranchers leasing grazing lands from BLM, individual plans would have to be developed prior to construction. These plans would identify means for minimizing impacts to lessees and potential mitigation measures. Mitigation measures could include providing feed for animals if the rancher has no alternative pastures and excluding livestock from newly seeded areas for at least two seasons after planting to allow reestablishment.

Irrigation Facilities and Systems. Impacts on irrigation facilities are considered negligible because the proposal would avoid mechanical irrigation circles, as well as drain tiles.

Farm Protection Act and Prime Farmland. Prime farmland is defined based on soil types and includes soils not currently in agricultural production. Impacts on agricultural land currently in use, including that considered prime farmland, are primarily from construction activities. Such impacts are considered minor because of the short, temporary duration of construction activities and the restoration of agricultural lands to their pre-existing soil types and graded levels. Therefore, there would be a minimal loss of prime farmland.

The only permanent loss of productive agricultural land would be 10.9 ha (27 acres) of timothy hay production at the Kittitas Terminal and 0.6 ha (1.5 acres) of alfalfa production at the Othello Pump Station. Both sites have soil types considered prime farmland. As described under "Operational Impacts - Overall Proposal", the total cropland lost as a result of constructing and

operating these facilities would be approximately 11.5 ha (28.5 acres) and is considered a minor impact to crops and cropland.

According to the Farmland Protection Act, federal agencies must examine their actions for potential adverse effects on farmlands, as determined by applying the criteria established for federal rules (7 CFR 658.4). The USFS, as federal lead agency for this EIS, is evaluating the potential adverse effects of the proposal on farmlands, and has determined that the proposal would have a minor impact on farmlands.

Further, Section 658.4(a) of the Farmland Protection Act states that the NRCS may determine potential adverse effects. According to NRCS policy, although the NRCS is responsible for maintaining a current inventory of prime farmland and unique farmland, it is the responsibility of appropriate local and state officials to evaluate prime farmland on a case-by-case basis (Natsuhara pers. comm.).

The impact of losing 11.5 ha (28.5 acres) of prime farmland is considered minor because the effect of the proposal on crops and croplands at these sites would be minor, because the amount of lost prime farmland is negligible, and because OPL is coordinating with the appropriate local and state officials as required by NRCS policy.

Construction Impacts - Columbia River Approach and Crossing Options. There would be no impacts to croplands and irrigation facilities in these sections because no crops are currently cultivated in the Ginkgo Petrified Forest State Park, YTC, or the Columbia River crossing areas. There is rangeland which may support livestock, but impacts to livestock would be minor for the reasons described under "Livestock" above.

Operational Impacts - Overall Proposal. As stated under "Construction Impacts", most agricultural activities along the proposed pipeline could resume once construction is complete. However, certain activities in the ROW would be restricted for the life of the project, including activities involving the excavation of dirt below 0.9 to 1.2 m (3 to 4 feet) and the planting of woody tree species. This impact is considered minor because of the small area affected. In addition, most crops only require excavation of much less than 1.2 m (4 feet) -- generally a few inches up to a foot is excavated. A minimum of 1.2 m (4 feet) of soil cover will be placed over the pipeline where deep tilling occurs (although no place was identified along the pipeline where deep tilling would be required).

Agricultural activities could not resume at the Kittitas Terminal or Othello Pump Station sites. At the Kittitas Terminal, there would be a loss of 10.9 ha (27 acres) of timothy hay production. At the Othello Pump Station, there would be a loss of 0.6 ha (1.5 acres) of alfalfa production. The total cropland lost as a result of the construction and operation of these facilities would be approximately 11.5 ha (28.5 acres). This impact is considered minor because of the relatively small amount of cropland lost (a fraction of a percent of the total county cropland), and because farmers would be compensated for land permanently removed from productive use.

Additionally, the Kittitas Terminal site vicinity could be considered in a state of transition. Although the unincorporated land is currently zoned agriculture, it is within the City of Kittitas urban

growth area with a general industrial zoning designation, which has been accepted by the county (although a rezone has not yet occurred) (refer to "Effects on Future Land Uses" in Section 3.12).

There would be no impacts on livestock as a result of operation except that livestock should be kept from the ROW until vegetation is reestablished. Impacts relative to the Farmland Protection Act and prime farmlands would be minor, as discussed above.

Operational Impacts - Columbia River Approach and Crossing Options. There would be no impacts to croplands and irrigation facilities because no crops are currently cultivated in the Ginkgo Petrified Forest State Park, YTC, or the Columbia River crossing areas. Although there is rangeland that may support livestock, there would be no impacts to livestock as a result of operation.

Cumulative Impacts. The only currently productive agricultural land that would be lost is 10.9 ha (27 acres) of timothy hay at the Kittitas Terminal site and 0.6 ha (1.5 acres) of alfalfa at the Othello Pump Station for a total of 11.5 ha (28.5 acres). The cumulative impact of the lost cropland is considered minor because of the small amount of cropland lost, relative to that being produced in the county (a small fraction of a percent). The Kittitas Terminal is located within an urban growth area near I-90.

3.13.2.2 No Action

Under the No Action Alternative, no new pipeline and associated facilities would be constructed, and there would be no effects on agricultural lands. Under No Action, the number of barges and trucks carrying petroleum products would likely double over the next 30 years. This may increase the demand for supporting facilities in ports and along the highway (i.e., gas stations, mini-marts, and rest stops), which could result in the conversion of agricultural land, but this is uncertain. The land use effect of developing such facilities is considered minor.

3.13.3 Additional Proposed Mitigation Measures

No additional mitigation beyond that included as part of the project by the applicant is proposed.

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3.14 RECREATION

3.14.1 Affected Environment

Outdoor recreation is an integral facet of the quality of life in the Pacific Northwest. Fifty-one million recreationists visited Washington state parks alone in 1996 (Burnett pers. comm). Many millions more visit community parks, fishing areas, national forests, and other recreational facilities. Because of this pervasive use, many people are easily exposed to disturbances in or near Washington's recreational facilities.

This section discusses formally established recreation sites. Additional recreational uses, such as fishing, hiking, bicycling, and other activities, occur throughout the area. Fifty-seven public and private recreational facilities are located within 8 km (5 miles) of the pipeline corridor (OPL 1998) and were examined for possible impacts (Figure 3.14-1). The pipeline corridor would physically intersect four public, one semi-private, and one private recreational facility: Echo Falls Country Club (private), Cedar Falls Trail (public), Mount Si Golf Course (semi-public), John Wayne Pioneer Trail/Iron Horse State Park (public), Ginkgo Petrified Forest State Park (public), and Twin Falls State Park (public).

3.14.1.1 Camping Facilities

Five public camping facilities are located within 8 km (5 miles) of the pipeline corridor. These five campgrounds are on USFS land or Washington Parks and Recreation Commission facilities. The 294 campsites at these campgrounds provide recreational opportunities for 2,056 campers each day (Table 3.14-1).

3.14.1.2 Hiking, Equestrian, Mountain Bike, Snowmobile, and Cross-Country Trails

Sixteen facilities providing hiking and equestrian trails, mountain bike trails, snowmobile trails, and cross-country amenities lie within 8 km (5 miles) of the corridor. The trails are owned by various city, county, state, and federal agencies as shown in Table 3.14-2. All the trails listed in Table 3.14-2 are non-motorized.

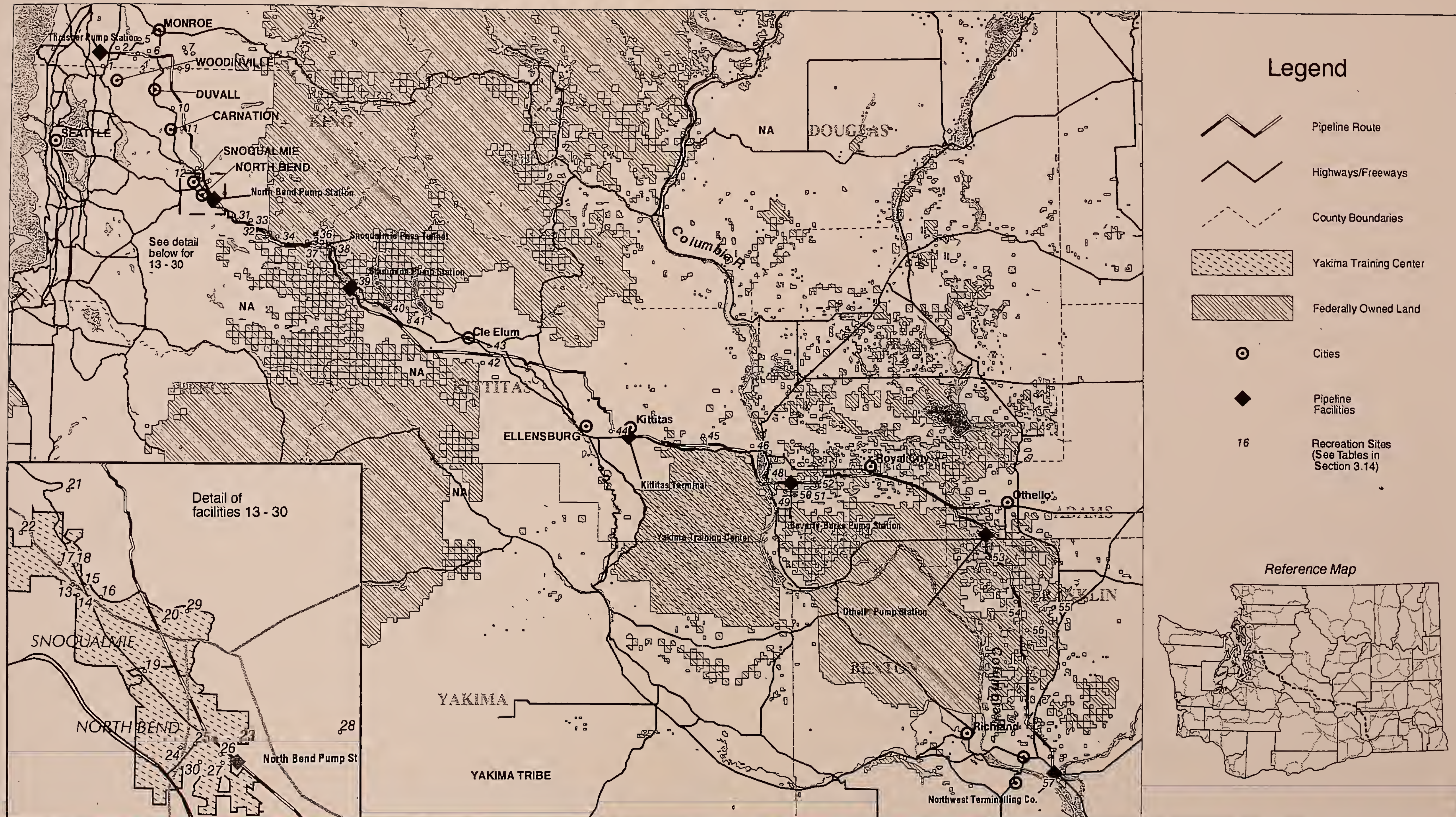
A major trail in the proposed project corridor is the Iron Horse State Park/John Wayne Pioneer Trail. Its designation as a linear park by the State of Washington is significant and unique because it is only one of three such parks in the state. As a state park, additional state regulations govern its operation and use, flora and fauna receive additional protection and maintenance priority, and visitors must abide by more defining regulations than for a trail.

Table 3.14-1. Public Campgrounds Located within 8 km (5 miles) of Pipeline Corridor

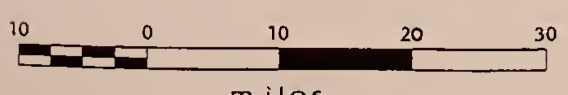
Location No.*	Facility	Owner	Characteristics
34	Tinkham Campground	United States Forest Service	47 sites; 5 people per site
36	Denny Creek Campground	United States Forest Service	35 sites; 5 people per site
39	Crystal Springs Campground	United States Forest Service	25 sites; 6 people per site
40	Lake Easton State Park	Washington Parks and Recreation Commission	137 sites; 8 people per site
46	Ginkgo Petrified Forest State Park	Washington Parks and Recreation Commission	50 sites; 8 people per site

Note: Camping is not an established use of the Mesa Lake Access and Clark Pond Access. No facilities are maintained at either site (Mahoney pers. comm.).

*See Figure 3.14-1 for locations.



APPROXIMATE LOCATIONS OF RECREATIONAL FACILITIES IN PROJECT VICINITY



Cross Cascade Pipeline
Washington
FIGURE 3.14-1

Table 3.14-2. Non-Motorized Trails within 8 km (5 miles) of Pipeline Corridor

Location No.*	Facility	Owner	Characteristics
1	North Creek Sports Field	City of Bothell	Trailhead
5	Lord Hill Park	Snohomish County	Scenic viewpoints, trails
15	Sandy Cove Park	City of Snoqualmie	Nature trail
17	Snoqualmie Centennial Trail	City of Snoqualmie	Black topped trail
18	Kimball Creek Nature Trail	City of Snoqualmie	Nature trail
20	Cedar Falls Trail	King County	Trail on old railroad right-of-way
21	Snoqualmie Valley Trail	King County	Trail on old railroad right-of-way
22	Preston-Snoqualmie Trail	King County	Trail on old railroad right-of-way
23	E. J. Roberts Park	City of North Bend	Trails
28	Mount Si Preservation Area	Washington Department of Natural Resources	Hiking, trails
31	Twin Falls State Park	Washington Parks and Recreation Commission	Trails
32	Iron Horse State Park and John Wayne Pioneer Trail	Washington Parks and Recreation Commission and U.S. Forest Service	Trail on old railroad right-of-way
33	Olallie State Park	Washington Parks and Recreation Commission	Trails
35	Asahel Curtis	United States Forest Service	Trails
37	Pacific Crest National Scenic Trail	United States Forest Service	Trail
40	Lake Easton State Park	Washington Parks and Recreation Commission	Trails

*See Figure 3.14-1 for locations.

3.14.1.3 Community Parks, Sports Fields, Interpretive Centers, and Preserved Lands

Eighteen community-oriented parks and other facilities are located within 8 km (5 miles) of the pipeline corridor. The city, county, state, and federal facilities listed in Table 3.14-3 provide a wide variety of recreational opportunities to the surrounding communities.

Table 3.14.3. Community-Oriented Recreational Facilities within 8 km (5 miles) of Pipeline Corridor

Location No.*	Facility	Owner	Characteristics
1	North Creek Sports Fields	City of Bothell	Sports fields
2	Maltby Regional Park	City of Monroe	Multipurpose sports fields
12	Fall City Community Park	King County	Baseball field, picnic tables, horse arena
13	Railroad Square	City of Snoqualmie	Interpretive displays, benches, gazebo, kiosk
14	Railroad Avenue Parkway	City of Snoqualmie	Open space, greenbelt
16	River View Park	City of Snoqualmie	Picnic tables, playground equipment, restrooms
19	Meadowbrook Farm	City of Snoqualmie, City of North Bend	Currently undeveloped, open space
23	E.J. Roberts Park	City of North Bend	Playgrounds, tennis courts, basketball court, horseshoe pit, trails, restrooms
24	Gardiner-Weeks Memorial Park	City of North Bend	Snoqualmie Valley Historical Museum, Mt. Si Senior Center, North Bend Chamber of Commerce, picnic tables, walking paths
25	William Henry Taylor Park	City of North Bend	North Bend railroad depot for Puget Sound and Snoqualmie Valley Historical Railway, ticket office, meeting rooms, restrooms
26	North Bend Athletic Complex	City of North Bend	Softball/baseball fields, youth baseball field, concession building, restrooms
27	Torguson Property	City of North Bend	Currently vacant
30	Si View Park	King County	Youth baseball fields, unimproved soccer fields, tennis courts, playground, swimming pool, gymnasium, classrooms, picnic tables, restrooms
44	Olmstead Place State Park	Washington Parks and Recreation Commission	Early homestead site, interpretive center and museum

Table 3.14.3. Community-Oriented Recreational Facilities within 8 km (5 miles) of Pipeline Corridor

Location No.*	Facility	Owner	Characteristics
46	Ginkgo Petrified Forest State Park	Washington Parks and Recreation Commission	Interpretive center, picnic tables, swimming, trails, and restrooms
47	Wanapum Dam Tour Center	Grant County PUD	Columbia River Historical Interpretive Center
52	Columbia National Wildlife Refuge	United States Fish and Wildlife Service	23,000 acres of channeled scablands of Columbia River Basin, wintering area for over 100,000 waterfowl, scenic viewpoints, fishing, hunting
54	Basin City Memorial Park	Franklin County	Picnic tables, playground equipment, horse arena

*See Figure 3.14-1 for locations.

3.14.1.4 Shoreline Access Points

Table 3.14-4 lists 26 shoreline access points located within 8 km (5 miles) of the pipeline corridor. These facilities provide recreational access for boat launching, fishing, swimming, and other activities.

Table 3.14-4. Shoreline Access Points within 8 km (5 miles) of Pipeline Corridor

Location No.[a]	Facility	Owner	Characteristics[b]
3	Echo Lake Access	Washington Department of Fish and Wildlife	Shoreline access, restricted boat launch
4	Devil's Lake Access	Washington Department of Fish and Wildlife	Shoreline access, restricted boat launch, fishing
6	Snoqualmie River Access	Washington Department of Fish and Wildlife	Shoreline access, restricted boat launch, fishing
7	Lake Fontal Access	Washington Department of Fish and Wildlife	Shoreline access, fishing
8	Lake Hannan Access	Washington Department of Fish and Wildlife	Shoreline access, fishing
9	Lake Margaret Access	Washington Department of Fish and Wildlife	Shoreline access, restricted boat launch, fishing
11	Langlois Lake Access	Washington Department of Fish and Wildlife	Shoreline access, restricted boat launch, fishing
15	Sandy Cover Park	City on Snoqualmie	Shoreline access
16	River View Park	City of Snoqualmie	Shoreline access
18	Kimball Creek Nature Trail	City of Snoqualmie	Shoreline access
29	Three Forks Park	King County	Shoreline access, passive recreation
33	Olallie State Park	Washington Parks and Recreation Commission	Shoreline access
34	Tinkham Campground	United States Forest Service	Shoreline access
36	Denny Creek Campground	United States Forest Service	Shoreline access
38	Keechelus Lake Access	United States Bureau of Reclamation/United States Forest Service	Shoreline access, non-restricted boat launch, fishing
39	Crystal Springs Campground	United States Forest Service	Shoreline access
40	Lake Easton State Park	Washington Parks and Recreation Commission	Shoreline access, non-restricted boat launch, swimming, fishing
41	Lavender Lake Access	Washington Department of Fish and Wildlife	Shoreline access, restricted boat launch
43	Yakima River Access	Washington Department of Fish and Wildlife	Shoreline access, restricted boat launch, fishing
46	Ginkgo Petrified Forest State Park	Washington Parks and Recreation Commission	Shoreline access, non-restricted boat launch, swimming, fishing

Continued

Table 3.14-4. Shoreline Access Points within 8 km (5 miles) of Pipeline Corridor

Location No.[a]	Facility	Owner	Characteristics[b]
48	Columbia River Access	Washington Department of Fish and Wildlife	Shoreline access, non-restricted boat launch
49	Nunnally Lake Access	Washington Department of Fish and Wildlife	Shoreline access, fishing
51	Lower Crab Creek Access	Washington Department of Fish and Wildlife	Shoreline access, restricted boat launch
55	Mesa Lake Access	Washington Department of Fish and Wildlife	Shoreline access, restricted boat launch, fishing
56	Clark Pond Access	Washington Department of Fish and Wildlife	Shoreline access, restricted boat launch, fishing
57	Sacajawea State Park	Washington Parks and Recreation Commission	Shoreline access, non-restricted boat launch, swimming, fishing

[a] See Figure 3.14-1 for locations.

[b] "Restricted boat launch" indicates there are size and/or power limitations on boat types that may be used at this site (Chaney pers. comm.)

3.14.1.5 Hunting

Eight official hunting and wildlife areas lie within 8 km (5 miles) of the corridor. Seven areas are administered by the Washington Department of Fish and Wildlife and include the Snoqualmie Valley Wildlife Area (Stillwater Unit) (10), the L. T. Murray Wildlife Area (42), the Quilomene Wildlife Area (45), the Crab Creek Wildlife Area (52), the Wahluke Wildlife Area (53), the Mesa Lake Access (55), and Clark Pond (56). The eighth area, the Columbia National Wildlife Refuge (52) is administered by the U.S. Fish and Wildlife Service. (See Figure 3.14-1 for the facility locations indicated in parentheses.)

3.14.1.6 Semi-Public Recreational Facilities

Six prominent semi-public recreational facilities are located within 8 km (5 miles) of the pipeline corridor. Two golf courses, Mt. Si Golf Course (segment 15), located west of the City of North Bend, and Echo Falls Country Club (segment 3), located in Snohomish are located within the study area. Four ski areas also lie within the study area: Hyak, Alpental, Ski Acres, and Snoqualmie Pass.

3.14.1.7 Supply and Demand Levels, Seasonal Use Levels, Closures, and Access

Usage of these park and recreation facilities is highest during the drier summer months, especially on weekends. During spring and fall, most use levels decrease due to changes in the weather. In the colder winter months, usage levels at area parks and recreation facilities decrease substantially, and it is not uncommon for some of the more remote facilities to remain unused for several weeks. Trails are used by cross-country skiers in areas where ski park lots or other parking is available. The ski areas experience a busy winter recreation season (skiing, snowshoe, snow play), in addition to a busy summer recreation season (hiking).

In 1996 there were 37,606 non-utility campers and 38,807 utility campers at the five campgrounds within the vicinity of the pipeline corridor (Table 3.14-5) (L. Schmidt, T. Schmidt, Burnett, Redman, Mahaney pers. comms.). Washington Parks and Recreation Commission also tracks the number of day users in Washington state parks. Ginkgo Petrified Forest State Park received 26 times more day users than campers; Lake Easton received 19 times more day users than campers (T. Schmidt, Burnett pers. comms.).

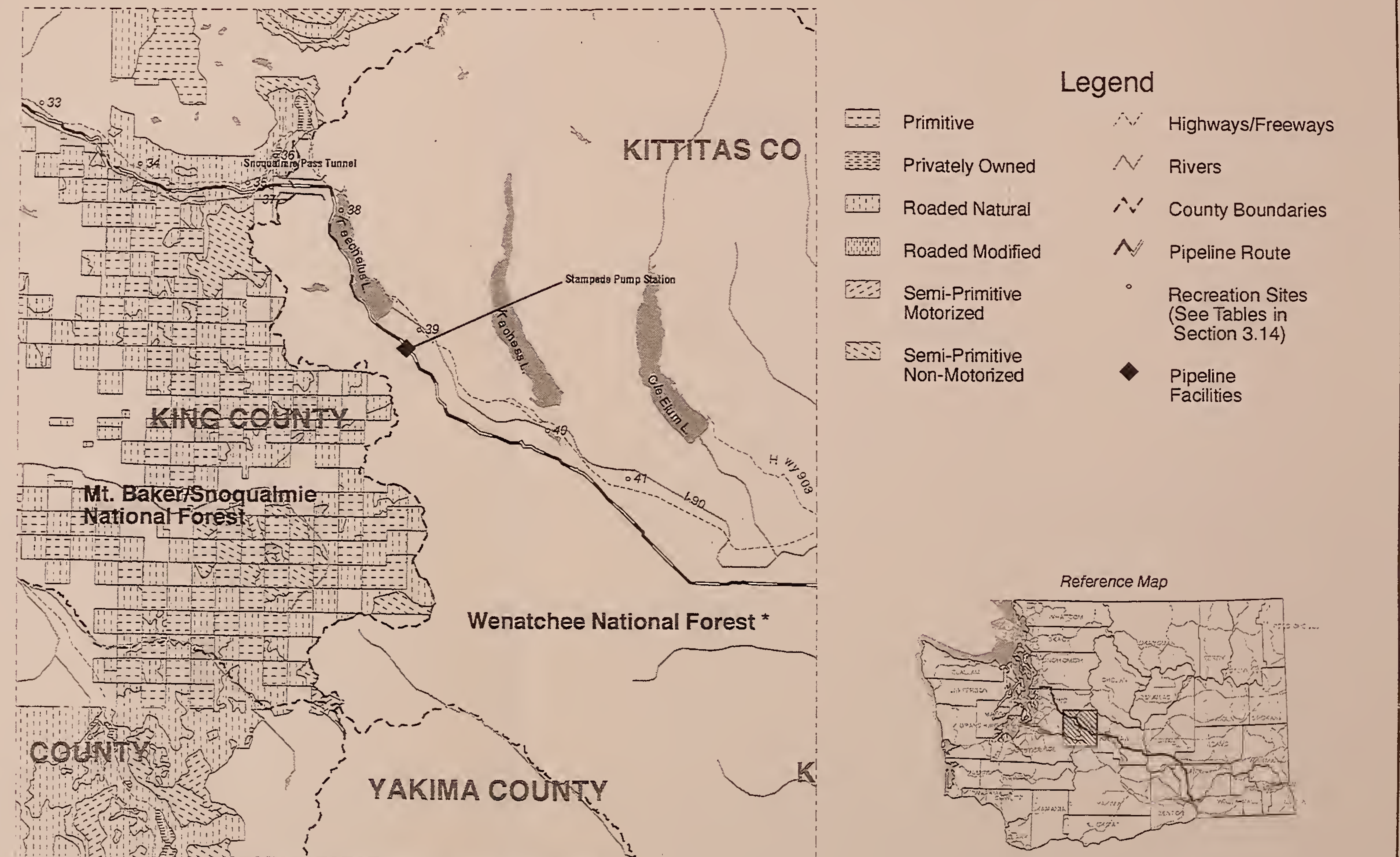
Table 3.14-5. Campground Supply and Demand Levels

Campground	Campers In 1996	Day Use Visitors In 1996
Tinkham Campground - USFS	4,392 Non-Utility Campers (open only 4 months)	Does not track
Denny Creek Campground - USFS	8,661 Non-Utility Campers (open only 4 months)	Does not track
Crystal Springs Campground - USFS	8,400 (open only 5 months)	Does not track
Lake Easton State Park - WA	15,866 Non-Utility Campers 15,578 Utility Campers	300,214
Ginkgo Petrified Forest State Park - WA	287 Non-Utility Campers 23,229 Utility Campers	618,925

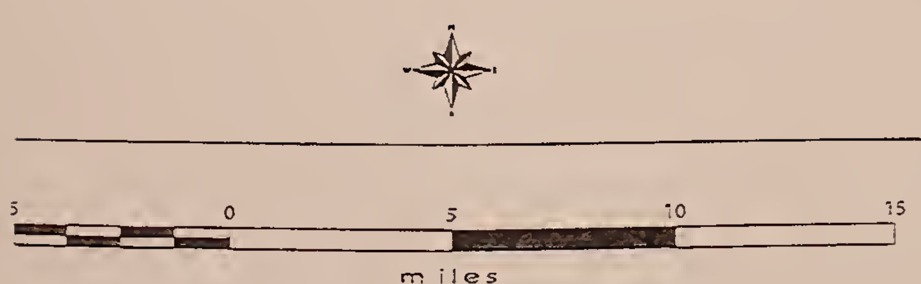
Note: Utility campsites refer to campsites that provide sewage hookup service for camp trailers. Non-Utility campsites may provide water from several taps, but few other facilities. Camping is not an established use of the Mesa Lake Access and Clark Pond Access. No facilities are maintained at either site (Mahoney pers. comm.).

3.14.1.8 USFS Recreation Opportunity Spectrum Classifications, Standards, and Guidelines

The pipeline would extend through approximately 18 km (11 miles) of national forest land along the 370 km (230-mile) corridor. The USFS developed the Recreational Opportunity Spectrum (ROS) to provide direction for land management and recreation planning within the national forests. ROS classes are used to identify current recreation uses on USFS land and to help specify the type and management of activities planned for the future (Murphy, Skistead pers. comms.). For location of ROS classifications, refer to Figure 3.14-2.



* Wenatchee National Forest ROS data are not available



U.S. FOREST SERVICE RECREATIONAL OPPORTUNITY SPECTRUM DESIGNATIONS

Cross Cascade Pipeline
Washington
FIGURE 3-14-2

The pipeline would cross through two national forests: Mt. Baker-Snoqualmie and Wenatchee. Two ROS classifications apply to areas traversed by the pipeline corridor: roaded natural and semi-primitive motorized. Table 3.14-6 describes the ROS classifications for the Mt. Baker-Snoqualmie and Wenatchee National Forests. Most of the pipeline corridor within the USFS lands is located in the Iron Horse State Park/John Wayne Pioneer Trail ROW.

Table 3.14-6. ROS Classification Descriptions

	Mt. Baker-Snoqualmie National Forest[a]	Wenatchee National Forest[b]
Rural	Site heavily modified. Some facilities designed strictly for comfort and convenience of users. Luxury facilities not provided. Facility design may incorporate synthetic materials. Extensive use of artificial surfacing of roads and trails. Vehicular traffic control usually obvious. Primary access usually over paved roads. Development density 3-5 family units per acre. Plant materials usually native. Interpretive services often formal or structured.	An area characterized by a substantially modified natural environment. Vegetation management and facility development is dominant. Here there is a moderate to high frequency of contact with other users in developed sites, on roads and trails, and on water surfaces. Many facilities are present to handle groups as well as individual users. Regimentation and managerial controls are numerous but largely in harmony with the natural environment.
Roaded natural	Site modification moderate. Facilities about equal for protection of site and comfort of users. Contemporary/rustic design of improvements is usually based on use of native materials. Inconspicuous vehicular traffic controls usually provided. Roads may be hard surfaced and trails formalized. Development density about 3 family units per acre. Primary access may be over high standard roads. Interpretive services informal, but generally direct.	All area predominantly natural appearing. Vegetation management and resource modifications are present but harmonize with the natural environment. A moderate opportunity exists for isolation and undisturbed activities. The area is located within ½ mile of better than primitive roads and railroads. There is a moderate to high probability of contact with other people on roads; low to moderate probability off roads and on trails. Onsite regimentation and controls are generally noticeable.
Semi-primitive motorized	Little site modification. Rustic or rudimentary improvements designed primarily for the protection of the site rather than the comfort of the users. Motorized access provided or permitted. Use of synthetic materials avoided. Minimum controls are subtle. Little obvious regimentation. Spacing informal and extended to minimize contacts between users. Primary access over primitive roads. Interpretive services informal, almost subliminal.	An area characterized by a predominantly natural or natural appearing environment. Here there is evidence of other users, but concentrations of users are low. There is a moderate probability of experiencing isolation and solitude. The area is located within ½ mile of primitive roads or trails used by motor vehicles, but not closer than ½ mile to roads of a higher standard than primitive. The area is at least 2,500 acres in size. Other people will be seen or encountered but not frequently. Onsite controls and regimentation will be present but subtle.

[a] Mt. Baker-Snoqualmie National Forest, Land and Resource Management Plan (USFS 1990a)
[b] Wenatchee National Forest, Land and Resource Management Plan (USFS 1990b)

3.14.2 Environmental Consequences

3.14.2.1 Proposed Petroleum Product Pipeline

Construction Impacts

Impacts on Recreational Facilities Avoided by Pipeline Corridor. Approximately 266 km (165 miles) of the pipeline would be constructed within or adjacent to existing utility or road ROW, including 34.0 km (21.1 miles) of the Iron Horse State Park/John Wayne Trail, and approximately 106 km (66 miles) would be constructed in new ROW. The pipeline corridor would avoid most of the public recreation facilities highlighted in the "Affected Environment" section. For these facilities, impacts would be limited to dust, temporary construction noise, and disruption of the recreational experience. These impacts would last from 1 to 2 days depending on the rate of construction.

Unusual amounts of dust created by construction activities would have a minor/negligible impact to recreationists during their stay. To control dust during construction, the ROW would be watered periodically as necessary, gravel would be applied to access roads where traffic volume is high, and construction would be curtailed while winds are high. Depending on the recreationists' location, the duration of their stay, and the existing background noise, construction noise would have differing levels of impacts, from minor to major. The noise impacts to a recreationist at any one location would be temporary, during daylight hours, and last for 1 to 2 days.

Construction activities would be in direct contrast to the natural, forested or rustic setting that recreationists expect to find in recreational areas. Visual disturbance would occur in the active construction zone and adjacent areas used for staging. The active construction zone would be approximately 305 m (1,000 feet) long. Construction activity would proceed 610 to 3,048 m (2,000 to 10,000 feet) a day. The visual impacts of construction during this time would be brief but major.

Impacts on Recreational Facilities Intersected by Pipeline Corridor. The pipeline corridor intersects Twin Falls State Park. The pipeline would also be buried under the trail ROW on both the Cedar Falls Trail (about 11.9 km or 7.4 miles) and Iron Horse State Park/John Wayne Pioneer Trail (about 34.0 km or 21.1 miles) and through Ginkgo Petrified Forest State Park. Impacts to Ginkgo State Park are discussed under Columbia River Approach and Crossing Options.

The portion of Twin Falls State Park crossed by the pipeline is currently forested and undeveloped. These trails are very popular with recreationists in the Puget Sound region. They received 134,165 day use visitors (Burnett pers. comm.) in 1996 alone, and experience heavy use by hikers, mountain bikers, nature observers, and other recreationists with high visual sensitivity. Because of their narrow linear nature, these trails would experience major short-term impacts in addition to the general impacts described above for the other recreational facilities (i.e., dust, noise, and visual disturbance).

Due to the constricted nature of the construction zone, vegetation along trails may be damaged during the stockpiling of soil along the trench. Because trails are usually comprised of

exposed soil, the duration of the visual impacts should be short. Disturbed vegetation within the trail corridors is expected to recover in 1 to 2 years.

Trenching would physically restrict trail use and could temporarily block access to adjacent campgrounds and trailheads. There are some areas along trails where the disturbed area is wide enough, or where detours onto roadways are possible in areas where roadways immediately parallel trails, that recreationists could be allowed to continue without waiting. However, there are narrow places along trails where there is no space for detouring around the construction activities, and those places would be closed during construction. If construction activities require temporary trail closures, recreational users would be delayed for up to 1 hour, and then construction would stop while the recreational users were escorted through the construction area, much as is done with a roadway project. The Cedar Falls Trail and Iron Horse State Park/John Wayne Trail would be signed near access points to alert recreational users to the construction activity and the potential delays during temporary closures. OPL is in the process of developing temporary signage and notices with King County for the sections of the route that utilize the Cedar Falls Trail. The notices would be posted approximately 30 days before construction would start along the trail, and would inform trail users of the approximate dates of construction, areas of temporary trail closures, and detour routes if available. A similar system could be developed for the John Wayne Trail.

The pipeline would be buried in the Snoqualmie Tunnel. Construction within the tunnel could take up to 2 weeks from start to completion. During construction, it may be necessary to temporarily close the tunnel to recreational users. If so, the users would be delayed at either end of the tunnel for up to 1 hour, and then shuttled through the tunnel using golf carts or similar small transports equipped with bicycle racks. The tunnel would likely be closed to equestrian users during the 2-week construction period.

Impacts from Construction Worker Housing. Two Washington State camping facilities (Lake Easton and Ginkgo Petrified Forest State Parks) would experience major impacts during construction if workers stay in campgrounds as a result of OPL's plan to house construction workers in trailers, campers, and other forms of temporary mobile housing at recreation facilities throughout the area. During the camping season, the demand for campsites at these locations ranges from 80 percent of capacity on weekdays to 100 percent of capacity on weekends. As shown in Table 3.14-7, the possible impact of campground use by construction workers ranges between 34 and 94 percent of capacity at these Washington state campgrounds. (L. Schmidt, T. Schmidt, Mahaney, Redman pers. comms.). If all workers are bussed to construction sites as stated by OPL, and not allowed to use campgrounds, impacts would be minor. The USFS prohibits the use of USFS campgrounds by construction workers working on USFS projects.

A potential negative effect of construction workers displacing tourists and recreationists could be experienced by businesses supported by those historic users (i.e., hotels, motels, stores). If construction workers displace tourists/recreationists in campgrounds and motels during construction, some of that income would be lost because of reduced spending (see Socioeconomics). Construction workers' expenditures would replace some of this loss, but not all because of differing spending patterns than tourists/recreationists.

Table 3.14-7. Campground Impacts

Campground	Number of Spaces Available	Limit of Stay	Number of Workers in Spread	Possible Percent of Impact*
Lake Easton State Park - WA	137 sites 8 people per site	10 days	375	34%
Ginkgo Petrified Forest State Park - WA	50 sites 8 people per site	10 days	375	94%

Note: Camping is not an established use of the Mesa Lake Access and Clark Pond Access. No facilities are maintained at either site (Mahoney pers. comm.).

* The percentage of impact is based upon the number of workers in the pertinent construction spread, divided by the total capacity of each campground.

Parking. Depending on the method of transport for the pipeline construction crews, the impacts on trailhead, campground, and other recreational facility parking could be major. If each construction team member chooses to drive a personal vehicle, crew automobiles could greatly exceed the parking capacity at each facility. This displacement of regular recreational users could encourage opportunistic parking in non-designated areas, and result in damage to the surrounding environment. To prevent undue disruption to recreationists' parking, OPL proposes to transport construction team workers to the construction site in buses or vans, although parking and pickup locations are not identified.

Sport Fishing. Because soil erosion would be minimized by BMPs (described in Appendix C), and stream access would not be limited, impacts to sport fishing would be negligible. However, sport anglers could experience temporary impacts from dust, noise, and degraded views during construction similar to the experience of other recreationists. See Section 3.7, Fisheries, for more information regarding fisheries.

Semi-Public Facilities. Construction of the pipeline would pass through two golf courses: Echo Falls Country Club and Mount Si Golf Course. Golf course use at Echo Falls varies throughout the year between 20 golfers per winter weekday and 200 golfers per summer weekend day (Joe pers. comm.). The alignment would enter the golf course in the existing BPA ROW through the rough. It would transition to the golf cart pathway to pass near course holes four and five. The alignment would transfer back to the BPA ROW to exit the golf course in the rough. All construction would either occur in the existing BPA ROW, located in the rough, or underneath the golf cart way. Construction on the Cedar Falls Trail would cross the Mount Si Golf Course. Golf course use varies during the year between five golfers per winter weekday and 400 golfers per summer weekend day (Campbell pers. comm.). At Cedar Falls construction would occur within the trail ROW.

The noise, dust, and construction view impacts to the golf course users at both golf courses would be similar to those discussed for trails. In addition, some interruption of golf course use could be expected during the brief (1- to 2-day) construction period. The golf course would remain open.

Construction would either be limited to an easily circumnavigable area or would occur during the slow winter season.

Recreational Opportunity Spectrum Designations. Pipeline construction would not permanently remove recreational capacity from any of the recreational facilities under consideration. In addition, the type of available recreational experience on USFS land would not change as a result of the buried pipeline, and thus all ROS designations would remain the same. See Figure 3.14-2 for ROS designations.

Columbia River Approach and Crossing Options. As part of the proposal, the pipeline corridor would cross Ginkgo Petrified Forest State Park. (See Figure 3.14-3 for crossing options.) Recreationists using the park would experience major impacts during construction including dust, noise, and views of construction equipment. Disturbed vegetation should recover in 1 to 2 years. This would detract from the park setting expected by most recreationists. Recreationists at Wanapum Campground, at Ginkgo Petrified Forest State Park, would experience increased dust, noise, and views of construction depending on the location of the Columbia River crossing. In both areas, construction vehicles could create congested traffic flows in and out of the campgrounds. Any construction alternative in the park during periods of more active use (May through September) would be disruptive to the recreational experience.

Alternative routes that cross through the YTC would avoid impacts on recreational facilities in this portion of the corridor.

Operational Impacts. Operational impacts would be negligible to minor at all recreational facilities. The only impacts would include weekly aerial overflights and some annual vegetation management practices, such as cutting or spraying where allowed. Recreational impacts from a spill would be major if a river or established recreation area is impacted. Spills up to 1 percent of flow may not be detectable with monitoring equipment. For this reason, spills along trails and state parks would be detected by odor or visual discovery which would be a negative impact to the recreational experience. Cleanup could close facilities until repairs are completed. Aesthetic effects of a spill may remain after biological effects have recovered.

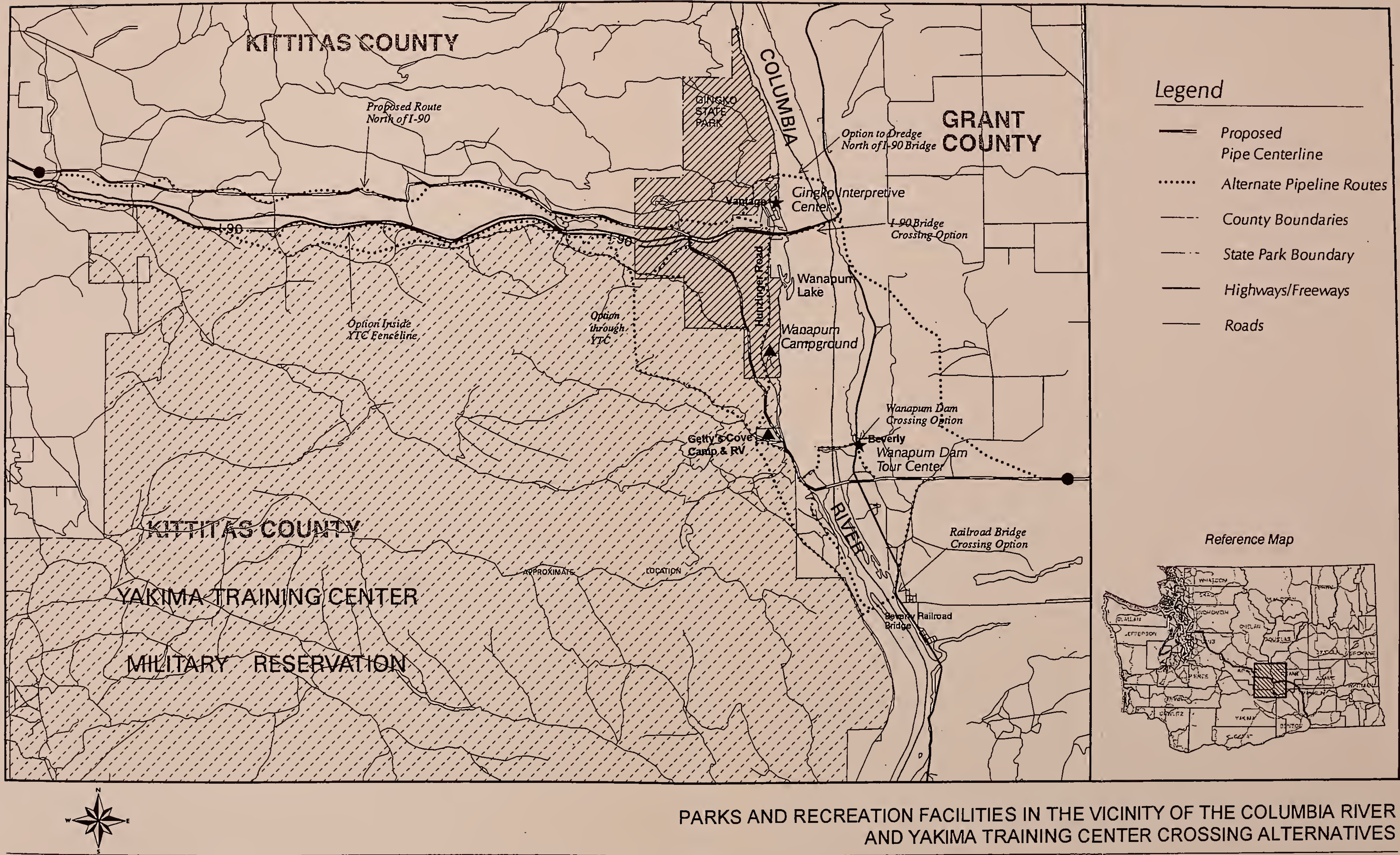
Cumulative Impacts. The pipeline would provide a cumulative beneficial impact from proposed improvements to trail facilities as part of the corridor restoration and maintenance, following pipeline installation. Other parts of the Iron Horse State Park/John Wayne Pioneer Trail are not currently improved and could be left in an improved condition with appropriate backfill, grading, and planting. No other cumulative impacts to recreation are anticipated.

3.14.2.2 No Action

There would be no impacts to recreation under the No Action Alternative because there would be no disruption of the recreational experience due to construction or operation of the pipeline. There would also be no cumulative beneficial impact from trail repair and upgrade during pipeline construction and maintenance.

3.14.3 Additional Proposed Mitigation Measures

No additional mitigation measures, beyond those already included as part of the project, are proposed for recreation. Suggested mitigation for worker housing impacts during construction is provided in Section 3.16, Socioeconomics.



PARKS AND RECREATION FACILITIES IN THE VICINITY OF THE COLUMBIA RIVER AND YAKIMA TRAINING CENTER CROSSING ALTERNATIVES

Cross Cascade Pipeline

Washington

FIGURE 3.14-3

3.15 VISUAL QUALITY AND AESTHETICS

This section evaluates visual resources in the areas through which the proposed pipeline would travel. The pipeline would traverse land managed by the USFS, BLM, the State of Washington, and private landowners. The methodology used to assess scenic resources and impacts generally conforms to the Visual Management System (VMS) developed by the USFS (n.d.) and the BLM's visual resource management program (1980).

Regional topography, landscape cover, and the proposed routing information were analyzed. Fieldwork consisted of driving and hiking the area to qualitatively determine general visibility of the pipeline corridor and related facilities from residences, major roads, and other potential sensitive viewpoints. Viewer types and their general sensitivity to visual changes were assessed.

Portions of the pipeline pass through USFS land. The USFS has developed its own VMS to inventory and manage the visual resources on National Forest lands. (USFS 1990a, 1990b.) The visual management inventory consists of three steps: landscape character type, variety class, and sensitivity levels of viewers overlain on distance zones. These steps are combined and interpreted to develop Visual Quality Objectives (VQOs). VQOs are described in the following section where the pipeline would pass through USFS land.

3.15.1 Affected Environment

3.15.1.1 Existing Visual Resources, Potential Viewers, and Viewing Patterns

At a regional level, the landscape settings are determined by topography, which establishes overall visual character at a broad scale. In western Washington, the pipeline would traverse low-lying lands and foothills with evergreen vegetation. Trees on the western side of the mountains tend to be predominantly Douglas fir, with ponderosa pine dominating on the eastern side. Lands in eastern Washington include large undeveloped areas and agricultural fields of dryland and irrigated crops. The proposed pipeline route was divided into segments based on visual settings. As the visual setting of the pipeline route changed, a new segment was identified.

The visual settings for selected segments of the pipeline, along with the potential viewer groups and viewer sensitivity, are described below. The ASC describes specific criteria for visual quality and visual/viewer sensitivity (OPL 1998). Milepost numbers given below are approximate and based on the current proposed pipeline centerline.

Visual Characteristics of Pipeline Corridor Segments. Table 3.15-1 summarizes the existing visual conditions along the entire pipeline. Segments of the pipeline with high viewer sensitivity or visual quality, and where high visual impacts are likely to occur, are highlighted in the following text discussion.

Table 3.15-1. Summary of Affected Environment for Visual Resources, Proposed Pipeline Route

Segment and Mileposts	Visual Quality	Viewer Sensitivity	Viewer Types	General Visual Setting of Pipeline Corridor
Segment 1 (MP 0.0 - 8.15)	M	H	Residents, ag. workers, local travelers, indust./comm. workers, recreationists (golf course)	Corridor begins in wooded urban/rural residential area; runs east along clearcut BPA corridor.
Segment 2 (MP 8.15 - 9.3)	M	M	Few viewers; ag. workers	Utility corridor; visual features include streamside veg. along Snoqualmie River; uniform hayfield/ pasture in floodplain.
Segment 3 (MP 9.3 - 11.9)	M	M	Few viewers	Utility corridor; similar to Segment 1 but less visually diverse.
Segment 4 (MP 11.9 - 13.0)	M	M	Travelers on W. Lake Kayak Rd. and Kayak Lake Rd.; few viewers	Departs corridor and crosses regenerating forest, enters rural residential area; veg. includes mixed forest, palustrine wetlands.
Segment 5 (MP 13.0 - 21.0)	M	H	Travelers on residential roads; most residences do not directly view BPA corridor	BPA utility corridor through rural residential area; mixture of forest and open space.
Segment 6 (MP 21.0 - 23.45)	L	M	Power and forest products company personnel, a few local residents	Forest road corridor (2nd and 3rd growth trees).
Segment 7 (MP 23.45 - 25.2)	H	H	A few rural residents, local travelers on Tolt River Rd NE, recreationists on Tolt River	Corridor crosses scenic forest; setting has varied topography, diverse veg.
Segment 8 (MP 25.2 - 25.9)	L	M	Forest company personnel, local travelers	Private road corridor through clearcuts, regenerating forest of generally low visual quality.
Segment 9 (MP 25.9 - 26.8)	L	L	Power company maintenance personnel	BPA utility corridor through clearcut forest.
Segment 10 (MP 26.8 - 27.15)	M	L	Few viewers	BPA corridor with more diverse topography and veg. along Griffin Creek; slightly higher visual quality than Segments 10 and 12.
Segment 11 (MP 27.15 - 28.05)	L	L	Travelers on unimproved road; few viewers	BPA corridor through uniform regenerating forest.
Segment 12 (MP 28.05 - 31.7)	L	L	Forest company personnel; a few local residents on unimproved roads; few viewers	Logging road corridor through coniferous and regenerating forest, wetlands.
Segment 13 (MP 31.7 - 32.1)	M	M	A few rural residents, local travelers, forest workers	Corridor passes through rural residential area, crosses Tokul Creek.
Segment 14 (MP 32.1 - 33.7)	M	M	Primary viewers are travelers on 396th Ave.; others include residents, quarry and sawmill workers, local travelers, recreationists using Snoqualmie River	Corridor follows 396th Ave. (county road) between rural residential area, rock quarry, Weyerhaeuser sawmill; departs road near MP 33.6; runs down vegetated slope to join railroad bed (Cedar Falls Trail).
Segment 15 (MP 33.7 - 41.0)	H	H	Residents, recreationists, travelers, workers	Follows Cedar Falls Trail across Snoqualmie River, through to golf course, through King County open space and North Bend, crosses I-90 and SF Snoqualmie River, passes through residential area, crosses a creek.
Segment 16 (MP 41.0 - 42.5)	M	H	Rural residents, I-90 travelers	Corridor crosses wooded area, passes adjacent to Twin Falls State Park, connects to abandoned railroad bed (John Wayne Trail).

Table 3.15-1. Continued

Segment and Mileposts	Visual Quality	Viewer Sensitivity	Viewer Types	General Visual Setting of Pipeline Corridor
Segment 17[a] (MP 42.5 - 43.9)	M	H	Recreationists (hikers, mt. bikers); no views from I-90	John Wayne Trail corridor; dramatic topography, uniform coniferous forest.
Segment 18 (MP 43.9 - 45.9)	H	H	Recreationists at state park; no I-90 views	Mt. Baker-Snoqualmie Natl. Forest land managed as "Scenic Forest"; portion follows Homestead Rd. next to Olallie State Park.
Segment 19[b] (MP 45.9 - 48.9)	H	H	Recreationists	Corridor follows road back to John Wayne Trail corridor, which is screened from I-90 view.
Segment 20[b] (MP 48.9 - 50.7)	M	H	Trail users and I-90 travelers	John Wayne Trail corridor, descends through forested slope to Tinkham Rd.
Segment 21[b] (MP 50.7 - 54.9)	H	H	Recreationists at campground and trailhead	Tinkham Rd. corridor past Tinkham Campground, Asahel Curtis Trail, Annette Lake Trailhead; steep topography, mixed forest, river and creeks.
Segment 22[b] (MP 54.9 - 56.2)	M	H	Recreationists using John Wayne Trail and I-90 travelers	Utility corridor in mountainous forested setting.
Segment 23 (MP 56.2 - 56.7)	M	H	Trail users	John Wayne Trail corridor through forest.
Segment 24[b] (MP 56.7 - 59.0)	L	H	Recreationists	Snoqualmie Tunnel.
Segment 25[b] (MP 59.0 - 73.35)	H/M	H	Workers, I-90 travelers, recreationists, forest and utility company personnel	Corridor follows John Wayne Trail through residential development, ski area, and along Keechelus Lake; Wenatchee Natl. Forest land managed under Visual Quality Objectives. Beyond MP 64, corridor is through forest and clearcut areas.
Segment 26 (MP 73.35 - 75.8)	M	L	Forest company and utility personnel	Departs John Wayne Trail, passes through forest, wetlands, utility/forestry clearings.
Segment 27[b] (MP 75.8 - 98.9)	M/L	L/H	Forest company and utility personnel, workers, travelers, recreationists	Most of segment is in BPA utility corridor 500 feet wide, through commercial forest, farmland, rangeland; numerous unimproved roads cross corridor. At MP 95.8, corridor crosses under I-90, travels downslope, crosses recreational trail, Yakima River, and SR 10; end of segment is in scrub-steppe.
Segment 28 (MP 98.9 - 100.4)	H	M	Occasional recreationists	BPA corridor across Swauk Creek; steep scenic canyon with oak habitat.
Segment 29 (MP 100.4 - 107.7)	L	L	Travelers on Hwy.97	Hilly rangeland, little veg. or water features.

Table 3.15-1. Continued

Segment and Mileposts	Visual Quality	Viewer Sensitivity		Viewer Types	General Visual Setting of Pipeline Corridor
Segment 30[a,c] (MP 107.7 - 149.14) *Includes three alternatives for approaching Columbia River*	L	North of 1-90	L	Rural residents, agricultural workers, 1-90 travelers, recreationists, military personnel	Corridor passes through pasture/rangeland, farm fields, numerous creek crossings. For three alternatives, two are rangeland adjacent to 1-90, one is rangeland/undeveloped Ginkgo State Park land.
	M	South of 1-90 up to MP 127.0	H		
	M	YTC fence after MP 127.0	H		
	L	YTC rangeland after MP 127.0	L		
	M	After MP 142.5	H		
Segment 31[a,d] (MP 149.4 - 150.0) *Includes five alternatives for crossing Columbia River*	M	Dredging	H	River recreationists	Minimal veg. and visual features exist along riverbanks.
	L	1-90 Bridge	H		
	M	HD Drilling	H		
	L	RR Bridge	H		
	L	Wanapum Dam	H		
Segment 32[d] (MP 150.0 - 151.8) *Includes five alternative corridor locations, depending on selected Columbia River crossing method*	M	North of 1-90	H	River recreationists	Corridor located along riverbank and/or across rangeland.
	L	1-90 to Hwy. 243	M		
	L	Hwy. 26 to Beverly	L		
	L	Wanapum Dam	M		
	L	RR Bridge	M		
Segment 33[d,e] (MP 151.8 - 221.0)	M	M		Farm residents, local travelers	Corridor parallels Beverly-Burke Rd., passes through industrial areas of Royal City, follows SR 26, crosses near Columbia NWR, through ag. fields; landscape includes farmsteads, country roads, rolling hills, irrigated farmland, grazing land. High variety of veg. types, colors, patterns, textures year-round.
Segment 34[d] (MP 221.0 - 227.5)	M	L		Agricultural workers, travelers along Hwy. 395, and local roads	BPA corridor through irrigated ag. fields; crosses Hwy. 395 and local roads.
Segment 35[d] (MP 227.5 - 231.0)	M	L		Farm residents, travelers, workers at NW Terminalling Co. storage facility	Ag. fields, Pasco industrial area, crossing of Hwy. 12 and local roads; visual character similar to Segment 34.

Table 3.15-1. Continued

Segment and Mileposts	Visual Quality	Viewer Sensitivity	Viewer Types	General Visual Setting of Pipeline Corridor

Notes: L = low, M = moderate, H = high.
Portions between MP 45 and 75 are within USFS lands.

[a] The segment crosses federal lands administered by the U.S. Bureau of Land Management
[b] The segment crosses federal lands administered by the U.S. Forest Service
[c] The segment crosses federal lands administered by the U.S. Department of Defense (Yakima Training Center)
[d] The segment crosses federal lands administered by the U.S. Bureau of Reclamation
[e] The segment crosses federal lands administered by the U.S. Fish and Wildlife Service

* Mileposts are approximate.

Source: Based in part on information provided by Dames & Moore for OPL's Application for Site Certification.

Segment 7 - Tolt River Vicinity. Both visual quality and viewer sensitivity are high in this segment. At this point, the pipeline would cross a scenic forest area before rejoining another private forest road. The area is scenic with great variation in topography as it slopes down to the Tolt River. The diverse vegetation includes coniferous forest, mixed forest, pasture, riparian growth along the river, and patches of wetland. Viewers include a few rural residents located near the river, local travelers on Tolt River Road NE, and recreationists using the Tolt River.

Segment 15 - Cedar Falls Trail, Snoqualmie River, Mount Si Area. This segment is the most scenic of the entire pipeline corridor. Both visual quality and viewer sensitivity are high. It follows a railroad bed (Cedar Falls Trail) across the Snoqualmie River (MP 34), runs through Mount Si Golf Course (MP 35), passes through King County open space, passes through the City of North Bend (MP 36), runs adjacent to school/playfields (MP 36.8) and regional business/industrial parcels, crosses I-90 and the South Fork of the Snoqualmie River, passes through a wooded residential area (MP 39.2) then around a wooded hillside (adjacent to I-90), and crosses Boxley/Christmas Creek.

Viewers include residents, recreationists (golfers, river users, trail hikers, etc.), regional and local travelers, industrial/commercial workers, and agricultural workers. Views exist where local roads cross the railroad bed and from higher overlook locations such as recreational trails leading up to Mount Si.

Segments 17 through 20 - Twin Falls State Park, John Wayne Trail Area to Tinkham Road. Visual quality in these segments is moderate to high, and viewer sensitivity is high. After departing from the railroad bed, the pipeline would cut through coniferous trees, follow a county road for 457.2 m (1,500 feet), traverse up a wooded slope through Twin Falls State Park (MP 41.7 to 41.9), and connect to the John Wayne Trail (an abandoned railroad bed). Viewers of the clearcut portions of the pipeline corridor include rural residents (foreground view range) and regional travelers along I-90 (middleground view range).

After MP 42.5, the pipeline would continue along the elevated John Wayne Trail. Topography here is dramatic, but vegetation is mainly uniform coniferous forest. Viewers include recreational hikers and mountain bikers using the trail. Because the trail is surrounded by forest on both sides, and is upslope from I-90, no view exists from the freeway.

From MP 43.9 to 45.9, the pipeline would enter the Mt. Baker-Snoqualmie National Forest. This area is managed under the VQO classification of "Scenic Forest" in which forest activities are to "retain or enhance viewing and recreational experiences." At MP 43.8, the pipeline would temporarily leave the John Wayne Trail and travel downslope to follow the ditch-line of a paved county road (Homestead Road). The road is adjacent to Olallie State Park which receives much day use and overnight camping. Visual quality along this segment is high because of the steep mountains, forest, and a meandering river through a canyon. Viewers include recreational users accessing the park. Views of the pipeline corridor are screened by dense vegetation from regional I-90 travelers.

Near MP 46, the pipeline would follow an upslope road and reconnect to the elevated John Wayne Trail, which is screened from I-90 view. Primary viewers along the entire segment consist of recreationists having high visual sensitivity.

The pipeline would continue along the John Wayne Trail to MP 48.9, where it would descend and cut through a forested slope to connect to Tinkham Road. Viewers are trail users and regional travelers on I-90.

Segment 21 - Tinkham Campground and Curtis/Annette Lake Trailhead Area. The pipeline would follow graveled Tinkham Road, passing Tinkham Campground, Asahel Curtis Interpretive Trail, and Annette Lake Trailhead, then turning up to the BPA corridor. Visual quality is high due to the steep topography, mixed deciduous/coniferous forest, and the meandering Snoqualmie River, Alice Creek, and Humpback Creek. Viewers consist of recreationists using Tinkham Campground and Curtis/Annette Lake Trailhead. On weekends, 300 to 400 people use the trailhead, and parking extends down Tinkham Road.

Segments 23, 24, and 25 - John Wayne Trail Corridor, Snoqualmie Tunnel, to Keechelus Lake. The pipeline would follow the elevated John Wayne Trail through coniferous forest interspersed with large patches of regenerating forest. The viewers of Segment 23 are generally trail users.

From MP 56.7 to 59.0, the pipeline would enter an abandoned railroad tunnel (Snoqualmie Tunnel). Viewers are recreationists within the tunnel, but there are no views within the tunnel. After leaving Snoqualmie Tunnel, the pipeline would continue to follow the John Wayne Trail through a mountain planned-unit development, the Hyak ski area, and travel along the shoreline of Keechelus Lake. Segment 25 would be located in the Wenatchee National Forest and would cross areas managed under the VQO classes of "Scenic Travel - Retention (ST-1)", "Scenic Travel - Partial Retention (ST-2)", "Riparian Zone (EW-2)", and "General Forest (GF)".

Under the "Retention" VQO, developments and forest management activities are generally not visually apparent in the foreground and middleground from developed recreation sites and designated roads and trails. In "Partial Retention" areas, visual changes are to appear as "near natural" (evident, but compatible) in the foreground and middleground along scenic travel corridors. Visual quality in this segment is high. Viewers are commercial workers, regional travelers along I-90, and a variety of recreational participants (hikers, skiers, mountain bikers, etc,). Travelers along I-90 have middleground views across Keechelus Lake of the pipeline corridor.

After MP 64, the pipeline would travel through coniferous and regenerating forest. Many clearcut utility corridors cross the area. Viewers include recreationists following the Iron Horse State Park/John Wayne Trail and forest or utility company personnel.

Portion of Segment 27 - Yakima River Area. Near MP 95.8, the pipeline would cross under I-90, travel downslope, cross a recreation trail (used by hikers, horse-drawn buckboards, etc.), cross the Yakima River, cross State Route 10, and ascend a steep slope. Viewers of this segment include forest and utility personnel, agricultural workers, local and regional travelers, and recreationists. Travelers on the recreation trail and State Route 10 and recreationists on the Yakima River have views of the pipeline corridor on the steep slopes facing the river. The pipeline would then travel through rangeland with scrub-steppe vegetation.

Pump Stations. The proposal includes five pump stations plus one at the Kittitas Terminal. Visual conditions of each pump station site, and viewers, are described below.

Thrasher Station (Segment 1, MP 0). The site is located adjacent to Puget Sound Energy ROW. The area has rolling topography and fairly diverse vegetation. Viewers include residents, but views of the station are blocked by surrounding forest. Visual quality and viewer sensitivity are high.

North Bend Station (Segment 15, MP 35.25). This site is located in an urban area between Cedar Falls Trail (abandoned railroad) and the USFS North Bend Ranger Station. Visual quality is low, while viewer sensitivity is high. The site is near an existing electrical substation and is visually screened from the Cedar Falls Trail by a vegetated area 12.2 m (40 feet) wide. Viewers consist of recreationists on the trail; however, most views of the site are screened.

Stampede Station (Segment 26, MP 67.1). This site is located in a partially cleared forest meadow. Visual quality within this area is moderate. Viewers are recreationists using the John Wayne Trail and forest products company personnel. Viewer sensitivity is high.

Beverly-Burke Station (Segment 33, MP 154.1). This site is located in rangeland that is not currently cultivated. The land surrounding the site is cropland and shrub-steppe rangeland having moderate visual quality. Viewers include a few local travelers along the Beverly-Burke Road. Visual quality is moderate; viewer sensitivity is low.

Othello Pump Station (Segment 33, MP 189.85). The Othello Pump Station would be located near State Route 24 at the corner of McKinney Road and a minor dirt road. Visual conditions and viewer types are similar to the Beverly-Burke Station. Visual quality is moderate, and viewer sensitivity is low.

Kittitas Terminal. The terminal would be constructed on a 10.9 ha (27-acre) site currently used for irrigated agriculture north of I-90 and east of Badger Pocket Road. Viewer sensitivity is high. Although the site is flat, visual quality is moderate due to the variety of color and patterns present throughout the year from agriculture. Viewers include travelers on the interstate. Westbound views are open, while eastbound views are partially screened by fill slopes of the Badger Pocket Road overcrossing. Overlooking views are particularly evident for travelers exiting on the off-ramp for Kittitas. Secondary viewers include agricultural workers.

3.15.1.2 Light and Glare

Existing light and glare levels vary at each of the six proposed pump station sites. Two of the sites, Thrasher and North Bend, would be located in areas of potential residential viewers. The Thrasher Station would be located in wooded surroundings, and the North Bend Station would be open to a new residential development planned for an adjacent site. The remaining sites (Stampede, Kittitas, Beverly-Burke, and Othello) would be located in remote sites having few viewers. The proposed Stampede Station would be located in forested surroundings, and the other three sites are in open range or agricultural surroundings.

The Kittitas Terminal site is an open agricultural field adjacent to I-90 and Badger Pocket Road which leads to Kittitas. Presently, some ambient light has been introduced to the area by overhead highway lights mounted on standard 12.2 m (40-foot) high side-arm poles located at the highway overpass and off-ramps.

3.15.2 Environmental Consequences

Visual impacts of the pipeline would be most noticeable during construction, when viewers would observe corridor clearing (where necessary), trenching operations, placement of pipe sections, backfilling/compaction, and vegetation seeding and restoration. After construction, visual impacts would depend on the amount of visual contrast created by trench scars relative to the amount and type of vegetation that was removed, local conditions affecting revegetation (slope steepness, soil type, rainfall, etc.), and exposure of viewers to the pipeline corridor. OPL is proposing various steps to minimize impacts, including:

- stockpiling topsoil to speed regeneration of vegetation,
- creating irregular corridor edges,
- providing visual screening vegetation around facilities, and
- using earth-tone colors for above-ground devices along the pipeline to blend with the natural surrounding.

Visual impacts generalized for the pipeline route are summarized below. See Figure 3.15-1 for pipeline ROW impacts through rangeland. The ASC describes specific criteria used to assess visual impacts (OPL 1998).

3.15.2.1 Proposed Petroleum Product Pipeline

Visual Impacts along Pipeline Corridor. Table 3.15-2 summarizes visual impacts along the pipeline corridor. Because visual conditions vary highly within route segments, a general overview of visual impacts based on landscape settings is provided below.

Pipeline Route in Utility Corridor. Much of the pipeline would follow existing utility corridors where visual impacts would be low. The BPA corridors are typically several hundred feet wide, and little new clearing of trees would be required. The growth of trees and large shrubs is limited within these maintained corridors, so pipeline trench scars would return to grass and small shrubs within a few years and not be noticeable within the larger corridor.

Pipeline Route through Residential Areas. At several locations along the corridor, the pipeline would pass through suburban and rural residential areas, such as Woodinville and North Bend. In general, visual impacts in these areas would be moderate. Residential viewers have high viewer sensitivity, but since the pipeline would typically follow powerline or old railroad corridors, visual disturbances would not be seen unless crossing the corridors or from elevated residences, public gathering sites (schools, etc.), and commercial/industrial sites. Many of the areas

Existing View

Simulated View

EXISTING AND SIMULATED VIEWS OF
PIPELINE RIGHT-OF-WAY THROUGH RANGELAND

Cross Cascade Pipeline
Washington
FIGURE 3.15-1

Table 3.15-2. Summary of Visual Impacts per Pipeline Route Segment

Segments	Existing Conditions		Visual Impacts		Comments
	Visual Quality	Visual Sensitivity	Impacts During Construction	Operational Impacts After Restoration	
2	M	H	M	L	Varied and sensitive viewers; screened views; some shrub clearing; impacts to Echo Falls Country Club
2	M	M	L	L	Limited view exposure; some shrub clearing within BPA corridor
9	M	M	L	L	Limited view exposure; patches of regen. forest; some shrub clearing
4	M	M	M	L	Limited view exposure; disturbed setting; some tree clearing
5	M	H	L	L	Limited view exposure; some shrub clearing within BPA corridor
6	L	M	L	L	Some view exposure; disturbed setting; disturbance to forest road
7	H	H	H	M	Scenic setting; moderate view exposure; tree cuts on creek slopes
9	L	M	L	L	Limited view exposure; disturbed surroundings; disturbance to forest road
9	L	L	L	L	Limited view exposure, disturbed setting; disturbances to forest road
12	M	L	M	M	Limited view exposure; some tree clearing on creek slopes
14	L	L	L	L	Limited view exposure; disturbed setting; some shrub clearing in BPA cor.
12	L	L	L	L	Limited view exposure; disturbed setting
13	M	M	M	L	Cuts on forested slopes, moderate view exposure
14	M	M	M	L	Moderate view exposure to sawmill workers/residents; disturbances to county road; short impact duration
15	H	H	H	L	High view exposure to trail users/some residents; short impact duration; impacts to Cedar Falls Trail, Mount Si Golf Course
16	M	H	H	H	Cuts on forested slopes; high viewer exposure to residents & I-90 travelers; forest cover expected to screen corridor from view of recreationists at Twin Falls State Park
17 [a]	M	H	H	L	Visual impacts to John Wayne Trail (heavily used); short impact duration; no view from I-90
18	H	H	H	L	Visual impacts to Olallie State Park recreationists; short impact duration; views from I-90 screened by veg.
19 [b]	H	H	H	M	Minor cuts on forested slope; disturbances to forest road

Continued

Table 3.15-2. Summary of Visual Impacts per Pipeline Route Segment

Segments	Existing Conditions		Visual Impacts		Comments
	Visual Quality	Visual Sensitivity	Impacts During Construction	Operational Impacts After Restoration	
20 [b]	M	H	H	H	High view exposure to JWT users; I-90 travelers would have potential views of corridor cut on forested slope (foreground to middleground)
21 [b]	H	H	H	M	Visual disturbances to Tinkham road/recreationists, tree cuts on connecting spurs between trail and utility corridor
22 [b]	M	H	M	M	Some cuts on forested slope for BPA connection; some viewer exposure
23	M	H	H	L	Visual impacts to John Wayne Trail (heavily used); short impact duration
24 [b]	L	H	H	L	Temporary visual disturbances/JWT closure through Snoqualmie tunnel
25					Potential views from Hyak Ski Area; visual impacts to JWT users; diverse viewers in area; short impact duration
< MP 62.5[b]	H	H	H	L	
>MP 62.5[b]	M	H	H	L	
26	M	L	M	M	Some tree clearing; disturbed setting; limited view exposure
27					
< MP 95[b]	M	L	M	L	Some tree cutting, but mostly within BPA corridor; limited view exposure
MP 95-96	M	H	H	M	Visible disturbances to slopes along Yakima River; diverse viewers
>MP 96	L	L	L	L	Rangeland scarring; moderate recovery time; limited view exposure
23	H	M	M	M	Oak cuts on slope of Swauk creek; permanent scars, limited view exposure
29	L	L	L	L	Rangeland scarring; mod. recovery time; limited views except MP 101.6
30					
N. of I-90[a c]	L	L	M	L	Short impacts to farmland; rangeland scarring; limited view exposure
S. of I-90 <MP 127	M	H	M	L	Many road/creek crossing; diverse viewers; short impacts to farmland
YTC fenceline >MP 127[a c]	M	H	M	L	Rangeland scarring; mod. recovery time; scarring visible to I-90 travelers
YTC rangeland >MP 127[a c]	L	L	M	L	Rangeland scarring (Yakima Training Center); mod. recovery time; lim. views
>MP 142.5[a c]	M	H	L	L	

Continued

Table 3.15-2. Summary of Visual Impacts per Pipeline Route Segment

Segments	Existing Conditions		Visual Impacts		Comments
	Visual Quality	Visual Sensitivity	Impacts During Construction	Operational Impacts After Restoration	
31					
Dredging[d]	M	H	M	L	Dredging north of I-90 Bridge; construction along banks would be viewed by recreationists using the river
I-90 Bridge[d]	L	H	L	L	Installing pipeline on side of I-90 Bridge; viewed by recreationists using the river, but visual quality of the river at the bridges is low.
HDDrill[d]	M	H	L	L	Crossing of Columbia by directional drill; would not include construction at the river bank.
RR Bridge[d]	L	H	L	L	Installing pipeline on side of Beverly Railroad Bridge; viewed by recreationists using the river, but visual quality of the river at the bridges is low.
Wanapum Dam[d]	L	H	L	L	Installing pipeline on side of Wanapum Dam
32					
N. of I-90[d]	M	H	M	L	Scarring to slopes facing Columbia River; rec. viewers; limited vegetation
I-90 to H 243[d]	L	M	M	L	Scarring to slopes facing Columbia River; rec. viewers; limited vegetation
H 26 to Beverly[d]	L	L	L	L	Scarring to rangeland; limited viewers
Wanapum Dam[d]	L	M	M	L	Scarring to slopes facing Columbia River; rec. viewers; limited vegetation
Railroad Bridge[d]	L	M	M	L	Scarring to slopes facing Columbia River; rec. viewers; limited vegetation
33 [d e]	M	M	M	L	Passes near many farm buildings, short recovery for scars in irrigated fields
34 [d]	M	L	L	L	Minimum disturbance in BPA corridor through ag. fields; res./hwy. viewers
35 [d]	M	L	L	L	Minimum disturbance to ag. fields/industrial area

Source: Based on OPL 1998.

Notes: L = low, M = moderate, H = high.

[a] The segment crosses federal lands administered by the U.S. Bureau of Land Management
[b] The segment crosses federal lands administered by the U.S. Forest Service
[c] The segment crosses federal lands administered by the U.S. Department of Defense (Yakima Training Center)
[d] The segment crosses federal lands administered by the U.S. Bureau of Reclamation
[e] The segment crosses federal lands administered by the U.S. Fish and Wildlife Service

* Mileposts are approximate.

are also wooded so vegetation is anticipated to provide partial screening of construction activities. Visual impacts would be temporary, and construction scars are expected to recover within 2 to 3 years.

Pipeline Routed along Recreational Trails. For approximately 45 km (28 miles), the pipeline corridor would follow the Cedar Falls and John Wayne Trails. For most of this distance, the visual setting is mountainous terrain of moderate to high visual quality. These trails also receive heavy use by hikers, mountain bikers, skiers, and other recreationists who have high visual sensitivity. Construction of the pipeline would pose temporary but high visual impacts to these recreationists. Although tree cutting would be minimized, soil stockpiling on one side of the trench would cover herbaceous plants and extend into adjacent trees where the trail corridor is narrow. Disturbed vegetation within the trail corridors is expected to recover in 1 to 2 years.

Construction of the pipeline along recreation trails would temporarily exceed the USFS VQO of "Retention" and "Partial Retention" within the Mt. Baker-Snoqualmie and Wenatchee National Forests. Visual changes would be evident in the foreground of recreation trails and forest cuts on slopes connecting the route between trails. Utility corridors would be visible in the middleground of primary scenic travel corridors such as I-90. For both "Retention" and "Partial Retention" areas, these short clearcut connections would exceed the USFS VQO, but some impact reduction and visual blending can be achieved through mitigation measures.

Pipeline Routed along Forest Roads. Many miles of the pipeline would be routed along private forest company or USFS roads. Along forest company roads, visual impacts would be low due to an already highly disturbed natural setting. The numbers of viewers would be low and sensitivity levels of these viewers, mostly forest products workers, is also low. For example, along segments such as Tinkham Road maintained by the USFS, visual impacts during construction would be moderate to high. The road is heavily used by visually sensitive recreationists who are accessing campgrounds and trailheads. The duration of visual impacts, however, would be short term, and permanent scarring would be minor, other than where connections occur between the road and utility corridor as described above.

Pipeline Routed through Rangeland. A long portion of the pipeline corridor would pass through a visual setting of rangeland. Visual impacts within the rangeland setting are expected to be low, with temporary visual contrast of a linear trench scar of exposed soil across rolling topography of grass and low shrubs. The rangeland setting has lower rainfall than other settings, so scars may take years to revegetate with grass, but scarring would not likely be permanent or evident. Much of the rangeland is more remote than other settings, and few viewers would see the scarring except where the route parallels highways.

Pipeline Routed through Agricultural Land. A portion of pipeline would run through agricultural land, usually along section lines or dirt roads. Because the fields are routinely tilled, temporary visual disturbances caused by trenching would generally be visually compatible with the agricultural context of this setting. Many of the fields are irrigated, so trenching scars are expected to recover within 1 year or less. Moderate visual impacts would be created where the corridor passes adjacent to farm buildings at close viewing ranges, or runs along dirt roads.

Visual Impacts at Pump Stations

Thrasher Pump Station. Visual impacts would be low due to screening. If the pump building is seen, it would be similar in visual character to other residential metal sheds and buildings in the area.

North Bend Station. Visual impacts would be low. The adjacent BPA substation establishes a semi-industrial context, and the pump station would be screened by vegetation from the adjacent Cedar Falls Trail. The land north of the pump station has been rezoned to multi-family; however, the land is currently undeveloped. Figure 3.15-2 shows the existing view at the site; Figure 3.15-3 shows a simulated view with the station in place.

Stampede Station. Visual impacts would be low. Some tree clearing may be required, but existing trees and shrubs on the heavily wooded site are expected to screen the facility from the John Wayne Trail recreationists and all other viewer groups.

Beverly-Burke Station. The pump station site is located adjacent to the paved Beverly-Burke Road near an irrigated field and would not be screened. Visual impacts would be moderate. Figure 3.15-4 shows the existing view of the site; Figure 3.15-5 simulates the view with the station in place.

Othello Pump Station. The pump station site is located adjacent to an apple orchard and bounded by dirt roads on two sides. Even though the site would not be screened, visual impacts would be low due to very minimal traffic.

Kittitas Terminal. The Kittitas Terminal and pump station would have high visual impacts due to its industrial character in an area of agriculture and grazing, and its visual dominance from I-90. Figure 3.15-6 shows the terminal site under existing conditions and with the proposal.

Light and Glare. All of the proposed six pump stations and the Kittitas Terminal will require minimum security lighting in the range of 1 to 3 foot-candles, which will be directed down and inward on the property. Visual impacts from light and glare at the pump stations and the terminal would be low. In forested locations, surrounding vegetation would screen much of the light spillover. At more open locations, the low light levels would be compatible with the surrounding residential development or farmsteads. Because lighting will be directed downward, glare is not expected to create impacts.

Columbia River Approach and Crossing Options. There are three primary alternative routes to the Columbia River crossing: the proposed route would continue on the north side of I-90 across private land and undeveloped portions of the Ginkgo State Park land; the second and third alternative routes would be south of I-90 on the YTC. For the proposed route north of I-90, the corridor would be located out of view of I-90 travelers (see Section 3.14 for potential effects on recreational users at the state park during construction). Between MP 127.2 to 129.2, the pipeline route south of I-90 would follow the south side of I-90, and travelers are expected to see slope scarring when the route turns southeast and heads up a slope between MP 129.2 and 130.2.

EXISTING VIEW
NORTH BEND PUMP STATION

Cross Cascade Pipeline
Washington

SIMULATED VIEW
NORTH BEND PUMP STATION

Cross Cascade Pipeline
Washington
FIGURE 3.15-3

EXISTING VIEW
BEVERLY-BURKE PUMP STATION

Cross Cascade Pipeline
Washington

SIMULATED VIEW
BEVERLY-BURKE PUMP STATION

Cross Cascade Pipeline
Washington
FIGURE 3.15-5

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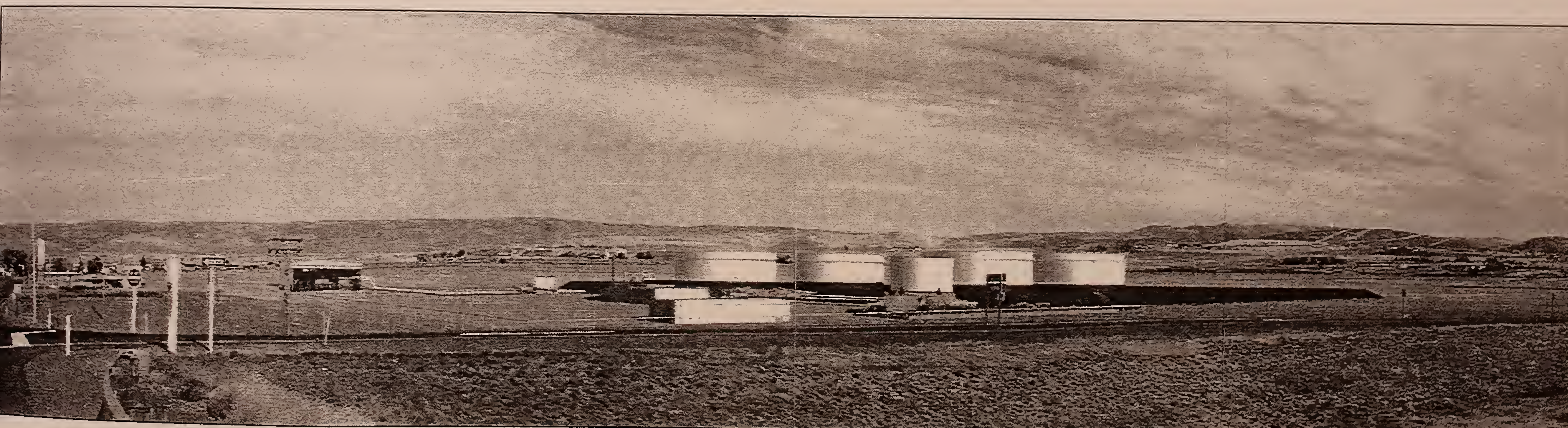
Existing View



Simulated View

EXISTING AND SIMULATED VIEWS OF KITTITAS TERMINAL

Cross Cascade Pipeline
Washington
FIGURE 3.15-6

The last portion of this segment (MP 129.2 to MP 144) passes through the Yakima Training Center. The landscape setting is hilly shrub-steppe which extends for miles with few, if any, landscape features of visual interest. One alternative route would be located near the northern fenceline of the Yakima Training Center which would be within view of travelers on I-90, and then south along Hunsinger Road to a crossing at either Wanapum Dam or farther south at the Beverly Railroad Bridge. Travelers are expected to see slope scarring.

The second alternative route would be located farther to the south of I-90 and would head southeasterly. Primary potential viewers along this portion of the segment would be military personnel. The remaining portion of the segment passes near Getty's Cove private campground (located within 500 feet of the pipeline route) near MP 144.7, passes adjacent to the Wanapum Dam, and travels down a steep slope to the Columbia River. Slope scars are anticipated to be seen by recreationists using the river.

Where the pipeline route crosses the Columbia River, there are minimal vegetation and visual features along the river banks. The proposed construction method and crossing location is a horizontal directional drill south of Wanapum Dam. Because the proposed river crossing method is directional drilling, there will be no construction along the banks.

There are four other alternative construction methods and locations for crossing the Columbia River: dredging across the river north of the I-90 bridge; hanging the pipeline on the I-90 bridge; hanging the pipeline on the Wanapum Dam; and hanging the pipeline on the Beverly Railroad Bridge which is downstream from Wanapum Dam. The dredged crossing north of the I-90 bridge would include construction along the banks. Slope scars are anticipated to be seen by recreationists using the river. Installing the pipeline on the side of the existing I-90 bridge or the Beverly Railroad Bridge would be seen by recreationists using the river; however the visual quality of the river under the bridges is low and would not be further degraded by the existence of the pipeline along the side.

On the east side of the Columbia River, the pipeline route would be determined by the selected crossing location for the Columbia River. If the dredged crossing north of the I-90 Bridge is selected, the route would be located along the river bank to the west of I-90 and would turn south to the intersection of I-90 and State Route 243. Slope scars are anticipated to be seen by recreationists using the river. The pipeline from either the dredged crossing or the I-90 Bridge crossing would then be located on the east side of State Route 243. Slope scars would be visible to travelers on the roadway. At the intersection with State Route 26, the pipeline would turn to the southeast and diagonally cross rangeland until it reaches the Beverly Burke Pump Station. The directional drill route south of Wanapum Dam would cross State Route 243 and travel up a slope located 0.8 km (0.5 mile) east of highway. The route utilizing the Beverly Burke Railroad Bridge would be located adjacent to State Route 243 for approximately 0.4 km (0.25 mile) and then cross rangeland in a north/northeasterly direction until intersecting with State Route 26. Visual features are similar to Segment 29.

Cumulative Impacts. Cumulative impacts on visual quality and aesthetics are generally considered minor because the majority of the pipeline would be sited in existing utility corridors, existing forest roads, and along established section lines through agricultural land. Such corridors generally attract linear projects because they provide a route with easier access and generally lower

impacts than new corridors. However, continued use of existing corridors can result in a growing corridor width which can exacerbate visual impacts, depending on the location. This cumulative impact of previous and future corridor users will continue to create these conflicts. In general, such impacts are likely to be less than establishing a new corridor for each and every project, which would minimize corridor width but greatly increase the number of corridors required.

3.15.2.2 No Action

There would be no impacts to visual resources resulting from the No Action Alternative because existing visual conditions would not be altered as part of new pipeline construction. Increased barge operation and truck trips would not affect visual resources.

3.15.3 Additional Proposed Mitigation Measures

No additional mitigation measures beyond those already included as part of the project are proposed.

3.16 SOCIOECONOMICS

3.16.1 Affected Environment

This section discusses population, housing, and economics based in part on Section 8.1 of the ASC. Please refer to that section for further details about these topics.

3.16.1.1 Population and Demographics

The proposal would occupy portions of six counties: from west to east, parts of southern Snohomish County, eastern King County, southern Kittitas and Grant Counties, a small area of the southwestern corner of Adams County, and the west-central area of Franklin County, terminating near the Snake River just east of Pasco.

The aggregate population of these counties was 2.29 million in 1995 (Washington State Office of Financial Management 1995). In addition to the rural areas that the pipeline corridor would pass through, this population figure includes metropolitan Seattle and other large urban cities in western King and Snohomish Counties that would not be directly affected by the proposal. The number of residents in unincorporated areas of these six counties was an estimated 837,827 persons as of April 1, 1995.

Table 3.16-1 provides data on the numbers of residents of the corridor counties in 1990 and 1995, distributed among unincorporated and incorporated areas. Except for King County, the corridor counties' unincorporated area populations grew between 1990 and 1995, continuing trends from the 1970s and 1980s, as did the incorporated communities along the ROW. Trends of population growth during the first half of the 1990s range from less than 1 percent per year to over 4 percent for unincorporated areas (excluding King County, which showed a decline in unincorporated area residents due to incorporation of several communities) as well as for the incorporated communities along the ROW.

King, Kittitas, and Snohomish Counties have higher proportions of their population in the working-age years of 18 to 64 than the more rural eastern counties of Adams, Franklin, and Grant. The percentage of citizens in the working-age years for the urbanized counties in 1990 ranged from 63 percent to 66 percent, while the rural eastern counties had a range of 55 percent to 56 percent, compared with 62 percent for Washington state (U.S. Bureau of the Census 1992). The more rural eastern counties have higher dependency ratios (the ratio of persons under 18 and those 65 and older to the total population) than the other three counties and the state as a whole. This smaller proportion of working-age population is fairly typical of rural counties.

Data on the gender and ethnic group characteristics of the proposal area counties along with corresponding statewide values are shown in Table 3.16-2. In the overall proposal area, females outnumber males (although not in the three eastern counties) and Caucasians predominate among the ethnic groups. See "Environmental Justice" below for a more in-depth discussion of ethnicity.

Table 3.16-1. Population Distribution in the Pipeline Corridor Counties

County	1990[a]	1995[b]	Average Annual Growth Rate: Percent per Year	Average Annual Growth Rate: Relative Rate
Snohomish - Total	465,628	525,600	2.45	high growth
Unincorporated	259,796	269,544	0.74	low growth
Incorporated	205,832	256,056	4.46	high growth
King - Total	1,507,305	1,613,600	1.37	moderate growth
Unincorporated	513,257	497,403	-0.63	negative growth
Incorporated	994,048	1,116,197	2.35	high growth
Kittitas - Total	26,725	30,100	2.41	high growth
Unincorporated	10,418	12,841	4.27	high growth
Incorporated	16,307	17,256	1.14	moderate growth
Grant - Total	54,798	64,500	3.31	high growth
Unincorporated	26,406	32,405	4.18	high growth
Incorporated	28,392	32,095	2.48	high growth
Adams - Total	13,603	15,200	2.24	high growth
Unincorporated	6,466	7,364	2.64	high growth
Incorporated	7,137	7,836	1.89	moderate growth
Franklin - Total	37,473	44,000	3.26	high growth
Unincorporated	14,712	18,270	4.43	high growth
Incorporated	22,761	25,730	2.48	high growth
Washington State	4,866,692	5,429,879	2.31	high growth

Source: Washington State Office of Financial Management 1995, U.S. Bureau of the Census 1992

[a] Census Bureau data as of 4/01/90
[b] Washington State Office of Financial Management estimate as of 4/01/95

Table 3.16-2. Gender and Ethnic Group Distribution of the Pipeline Corridor County Populations

County	Population (1993)	Male	Female	Caucasian		African American		Native American		Asian and Pacific Islanders		Other	
				Total	Percent	Total	Percent	Total	Percent	Total	Percent	Total	Percent
Snohomish	507,900	253,345	254,555	469,286	92.4%	5,818	1.1%	7,140	1.4%	21,596	4.3%	4,060	0.8%
King	1,587,700	782,313	805,387	1,320,897	83.2%	84,368	5.3%	18,723	1.2%	145,898	9.2%	17,814	1.1%
Kittitas	29,200	14,498	14,702	27,510	94.2%	156	0.5%	186	0.6%	844	2.9%	504	1.7%
Grant	60,300	30,535	29,765	49,425	82.0%	671	1.1%	673	1.1%	728	1.2%	8,803	14.6%
Adams	14,300	7,218	7,082	9,073	63.4%	33	0.2%	65	0.5%	102	0.7%	5,027	35.2%
Franklin	41,100	21,083	20,017	26,668	64.9%	1,306	3.2%	302	0.7%	1,156	2.8%	11,668	28.4%
Subtotal	2,240,500	1,108,992	1,131,508	1,902,859	-	92,352	-	27,089	-	170,324	-	47,876	-
Washington State	5,240,900	2,600,485	2,640,415	4,569,295	87.2%	170,399	3.3%	89,970	1.7%	268,550	5.1%	142,686	2.7%

Source: Washington State Office of Financial Management 1993, 1994.

3.16.1.2 Housing

According to the 1990 census, household sizes were generally higher in the three rural eastern counties, ranging from 2.74 to 3.03 persons per household, in comparison to the western counties, ranging from 2.33 to 2.68.

The westernmost counties of King and Snohomish had higher median values of owner-occupied dwellings ($140,100 and $127,200 respectively) than the other four counties (ranging from $45,900 to $60,500) or statewide ($93,400). Vacancy rates in Kittitas County and the three eastern counties also tended to be higher (a range of 10.7 percent to 20.8 percent) than in the westernmost counties (4.9 percent for King County and 6.6 percent for Snohomish County) and statewide (7.9 percent). However, it is likely that in the eastern, rural parts of King and Snohomish Counties, vacancy rates and median values were probably more comparable to the other counties' figures. Housing market conditions in large cities tend to be tighter than in rural areas.

3.16.1.3 Economy, Employment, and Income

The pipeline corridor counties have differing economic bases. The manufacturing, financial, business and personal services, and wholesale/retail trade sectors represent approximately 75 percent of the jobs and earnings by the populations of King and Snohomish Counties. The natural resource utilization (e.g., farming, forestry, fishing, and mining) and government sectors in Adams, Franklin, Grant, and Kittitas Counties represent the largest share of each respective population's jobs, 40 percent to 45 percent, and earnings, 45 percent to 60 percent.

Table 3.16-3 presents data on the composition of employment and earnings in the six counties in 1993. King and Snohomish Counties' large urban/industrial bases bias their data aggregates toward the manufacturing, financial, and business services industries, but in the rural, eastern parts of the counties, agriculture is a relatively more important economic activity.

Table 3.16-4 presents data on the socioeconomic conditions of the pipeline corridor counties. As the table shows, King and Snohomish Counties differ from the other four counties with respect to levels of income and employment. This difference is largely due to the more robust urban/industrial conditions generated by the Seattle metropolitan area and other urbanized areas of the region. See "Environmental Justice" below for a more in-depth discussion of this difference.

School districts collect the majority of local revenue, with intergovernmental transfers (primarily from the state) accounting for the bulk of the income. Local property taxes typically account for 10 to 20 percent of the total revenues for both types of jurisdiction, with the higher share occurring in Snohomish and King Counties with their larger residential and business property tax bases. Intergovernmental transfers account for a smaller share of government revenues in Snohomish and King Counties than in the more rural eastern counties.

Table 3.16-3. Employment and Income for the Pipeline Corridor Counties as of 1993

County		Agriculture, Forestry, and Fishing	Mining and Construction	Manufacturing	Transportation, Communication, and Utilities	Wholesale and Retail Trade	Financial and Other Services	Government	Total
Snohomish	Jobs	2.51%	7.33%	23.77%	3.14%	21.13%	29.96%	12.15%	237,303
	Earnings	$145	$539	$2,564	$260	$927	$1,389	$841	$6,664
	Per capita earnings	$24.3	$31.0	$45.4	$34.9	$18.5	$10.5	$20.2	$28.1
King	Jobs	1.26%	5.28%	13.37%	5.67%	22.46%	39.62%	12.35%	1,177,040
	Earnings	$526	$2,280	$7,028	$2,840	$6,532	$14,731	$4,619	$38,556
	Per capita earnings	$35.5	$36.7	$44.7	$42.5	$24.7	$31.6	$31,8	$32.8
Kittitas	Jobs	9.90%	3.38%	6.45%	4.01%	24.79%	24.31%	27.16%	14,280
	Earnings	$27	$11	$22	$18	$54	$45	$99	$276
	Per capita earnings	$10.1	$22.8	$23.9	$31.5	$15.3	$13.0	$23.5	$19.3
Grant	Jobs	20.29%	6.61%	10.96%	3.79%	21.07%	18.62%	18.65%	30,126
	Earnings	$191	$46	$95	$34	$104	$81	$157	$708
	Per capita earnings	$31.2	$23.1	$28.8	$29.8	$16.4	$14.4	$27.9	$23.5
Adams	Jobs	25.80%	2.12%	12.72%	5.24%	20.25%	17.61%	16.26%	8,381
	Earnings	$90	$4	$31	$10	$29	$21	$31	$215
	Per capita earnings	$41.6	$22.5	$20.1	$22.8	$17.1	$14.2	$22.9	$25.7
Franklin	Jobs	19.01%	4.67%	6.07%	5.81%	22.65%	24.32%	17.47%	22,246
	Earnings	$143	$27	$36	$50	$103	$98	$104	$561
	Per capita earnings	$33.8	$26.0	$26.6	$38.7	$20.4	$18.1	$26.8	$25.2

Source: U.S. Bureau of Economic Analysis 1995.

Notes: All earnings are in thousands of dollars.
Earnings are by place of work and include the proprietors' earnings.

Table 3.16-4. Proposal Area Socioeconomic Indicators

Parameter	Snohomish	King	Kittitas	Grant	Adams	Franklin	WA Statewide
Per capita income (1989)	$15,769	$18,587	$10,781	$10,376	$10,083	$10,407	$14,923
Population (4/1/89)	444,460	1,463,301	26,029	52,044	13,570	37,221	4,728,076
Number of families below poverty level (1989)	29,334	117,064	5,258	10,318	2,375	8,561	515,360
Percent families below poverty level (1989)	6.6%	8.0%	20.2%	19.6%	17.5%	23.0%	10.9%
Unemployment rate (1991)	5.6%	4.6%	10.5%	10.1%	13.4%	12.8%	6.3%
Number unemployed (1991)	13,180	40,350	1,330	2,875	1,020	2,225	157,370
Public Assistance (average number of persons per month and percent population, fiscal year 1995):							
AFDC - number	21,741	68,447	1,209	4.304	1,483	4,069	289,199
AFDC - percent	4.14	4.24	4.02	6.67	9.76	9.25	5.33
General assistance - number	1,765	6,297	71	186	41	118	20,796
General assistance - percent	0.34	0.39	0.24	0.29	0.27	0.27	0.38
Food stamps	4.0%	5.3%	6.9%	5.4%	8.5%	18.5%	7.5%
Food stamps - number	35,130	11,052	2,104	7,012	2,732	6,891	476,474
Food stamps - percent	6.68	6.88	6.99	10.87	17.97	15.66	8.78
Medical assistance - number	33,768	104,225	1,624	7,165	3,119	6,633	451,071
Medical assistance - percent	6.42	6.46	5.40	11.11	20.52	15.08	8.31

Source: U.S. Bureau of the Census 1992, Washington State Office of Financial Management 1995

Note: AFDC = Aid to Families with Dependent Children

3.16.1.4 Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, requires each federal agency to make the achievement of environmental justice part of its mission by identifying and addressing disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low income populations. The Order further stipulates that the agencies conduct their programs and activities in a manner that does not have the effect of excluding persons from participation in, denying persons the benefits of, or subjecting persons to discrimination because of their race, color, or national origin.

As shown in Table 3.16-2, minority groups represent less than 20 percent of the ethnic makeup of the pipeline corridor counties (except for Adams and Franklin Counties where over 35 percent of the population considers themselves of minority ancestry) as well as the State of

Washington in general. Asian and Pacific Islanders constitute the largest single ethnic minority group in each of the counties, except for Franklin County where African-Americans represent the largest minority group. Adams, Grant, and Franklin Counties do have substantial populations (ranging between 15 percent and 35 percent) that consider themselves of an ethnic background other than "standard" classifications.

The only Native American land in proximity to the pipeline corridor lies in Grant County and belongs to the non-federally recognized tribe of the Wanapum. As of 1980, four Wanapum families remained on the land. (Ruby and Brown 1992.) In addition, five Indian reservations are located along the west coast of Washington, on the Pacific Ocean, that could be affected by a product spill under No Action. These reservations include, from north to south, the Makah, Ozette, Quillayute, Hoh, and the Quinault Indian Reservations.

Table 3.16-4 indicates that the two western counties (King and Snohomish) have higher levels of per capita income (over $15,000 in 1989) and lower incidences of unemployment (approximately 5 percent in 1991), poverty, and public assistance than the eastern counties. The greater Seattle metropolitan area provides a vigorous urban/industrial condition that is exhibited in the standard of living in the region. The rural eastern counties had a 1989 per capita income range of $10,000 to $11,000 and exhibited 10 percent to 13.5 percent unemployment in 1991. Adams, Franklin, Grant, and Kittitas Counties also had approximately twice the number of families below the poverty level in 1989 than the statewide average or the western two counties.

3.16.2 Environmental Consequences

3.16.2.1 Proposed Petroleum Product Pipeline

Construction Impacts. As described in Chapter 2, the construction workforce for the proposal would be split into three construction spreads. Spread 1 would construct the western portion of the pipeline, Spread 2 would construct the central mountainous portion, and Spread 3 would construct the eastern portion. The construction workforce peak for each spread would be as follows: 375 workers for Spread 1, 159 workers for Spread 2, and 375 workers for Spread 3. Approximately 70 percent of the construction workers (640 workers for the three spreads) would come from outside the state.

Due to the concentration of activities in the 12-month construction period, this phase would generate the bulk of the proposal's overall socioeconomic effects (as opposed to the operation phase). Of particular interest to the socioeconomics analysis are the number of workers that would be hired locally from communities along the ROW (versus transferred in from out of the region, thus requiring temporary housing and other services); the wages and salaries that would be paid (of which a portion would be spent locally, thus benefitting local merchants); and the procurement of construction materials and services (also benefitting local suppliers as well as generating sales taxes).

Population and Demographics. The people most directly affected would be those living in communities close to the pipeline corridor. Incorporated towns and cities along the

corridor had 54,444 inhabitants in 1995. Data were not available for the populations of small unincorporated towns along the pipeline corridor. By best professional estimates (OPL 1998), the actual number of people that would be positively or negatively impacted by construction activities may be approximately 100,000 (OPL 1998). Indirectly, however, the entire population of each of the corridor counties would experience some effects, in part from jobs and income generated by the proposal, and in part from sales and use taxes accruing to local jurisdictions for procurement of taxable goods and from property taxes on the proposal lands and facilities.

The maximum expected duration of construction at any one location along the pipeline corridor is no more than 10 days under favorable weather conditions. Because of the short construction period within any one area and because the construction work would progress fairly rapidly, the proposal's direct construction impacts on population levels in any given community would be brief and negligible.

In addition, apart from the temporary and small increases in local populations from non-local construction workers, no permanent population changes are expected to occur as a result of the construction activities because non-local workers generally do not bring dependents along on jobs with moving work sites. Potential impacts to housing, employment, or the economics of local populations are addressed below.

Housing. Projected numbers of construction workers for each of the six counties in the peak 3 months and second and third highest months are summarized in Table 3.16-5. These figures establish the context for evaluating the adequacy of construction housing along the pipeline corridor.

Table 3.16-5. Projected Numbers of Transient Workers for Counties where the Pipeline would be Located

County	Peak Month	2nd Highest Month	3rd Highest Month
Snohomish	49	18	10
King	126	46	27
Kittitas	283	104	30
Grant	82	30	17
Adams	22	8	5
Franklin	103	38	22

Source: Dames & Moore estimates.

One further consideration is the type of housing that is needed. Construction workers for linear proposals like pipelines, highways, and transmission lines almost universally use recreational vehicles (RVs) for housing on the jobs away from home. Out-of-pocket running costs, including rental of RV park pads or campground space, are much lower than staying in motels or hotels (RV parks typically charge $10 to $15 per vehicle per night versus $40 to over $60 for hotel or motel

rooms outside of the metropolitan area), and relocation is much easier as construction progresses along the ROW. In some instances workers may pool resources and rent a house, condominium, or apartment; however, mobile accommodations are preferred for relatively short-term jobs.

Accordingly, statistics on vacancy rates and cost for single- and multi-family housing are not of much use in assessing the transient housing capacity of the area. More relevant is the status of RV parks, campgrounds, and mobile home parks as an indicator of the area's ability to accommodate non-local construction workers. AAA TourBook listings are considered here as a guide although they do not include all lodging and other non-listed lodging is generally available.

For the proposal, non-local and out-of-state workers employed on the western segments of the proposal would find RV parks and campgrounds, as well as motels and other accommodations, within reasonable commuting time of the construction site. King and Snohomish Counties, according to a commercial listing of RV parks and campgrounds, identify over 1,100 RV pads and campground sites in the communities of Everett, Lynnwood, Bothell, Sultan, Issaquah, Fall City, North Bend, and adjacent portions of the Mt. Baker-Snoqualmie National Forest (Woodall Publications Corp. 1996). The 175 peak phase non-local workers projected for the Snohomish and King County segments of the proposal would represent 15.9 percent of the area's transient accommodations.

Accommodations for the construction workforce in Kittitas County are less abundant than in the Seattle metropolitan area. Woodall's '96 Western Campground Directory lists 399 RV pads and campground sites with hookups in Ellensburg, Easton, and Cle Elum. Another 153 campground sites located in two campgrounds in the Wenatchee National Forest would not be available to the construction workforce because of USFS restrictions on such use. The American Automobile Association's 1996 Tourbook for Washington identifies four motels plus a small bed-and-breakfast establishment in Ellensburg for a total of 251 rooms, plus another four motels in Cle Elum with a total of 109 rooms, for a total of 360 rooms.

In total, Kittitas County has about 760 RV sites and motel rooms, versus a projected peak demand for temporary accommodations of approximately 280 non-local workers, or approximately 37 percent of the available transient housing. These sites may or may not be available, depending upon seasonal use. The actual number of RV sites or other transient accommodations required could be smaller, to the extent that workers double up, as is a common practice.

The eastern segments of the proposal would have a peak of approximately 100 non-local/construction workers in Grant and Adams Counties. They would have the choice of several RV parks and campgrounds along the pipeline corridor, as well as a number of motel rooms. The RV facilities that would be most convenient for workers in Grant and Adams Counties are located in the towns of Vantage and Moses Lake (Woodall Publications Corp. 1996). Vantage has a KOA RV park with 75 pads plus the Wanapum State Park with 50 campsites. Moses Lake has three RV parks with 430 pads plus the Potholes State Park with 120 campsites. Altogether, there are more than 675 pads and campsites in Grant and Adams Counties.

The American Automobile Association's 1996 TourBook for Washington lists one motel in Othello with 52 rooms and four motels in Moses Lake with 369 rooms, for a total of 421 rooms (although other motels exist in the area that are not in the AAA directory). Altogether, the

construction workers would occupy no more than 9.1 percent of the 1,096 RV pads, campsites, and identified motel rooms in Grant and Adams Counties, assuming one worker per RV pad, campsite, or room. Actual occupancy would be less than that when other motels not identified here are added to the inventory.

The Franklin County segment would have a peak of approximately 100 non-local/construction workers. The workers would be most conveniently served by RV parks in Pasco, Richland, and Kennewick (with a total of 332 pads) and three ACOE campgrounds in Burbank with 184 campsites (Woodall Publications Corp. 1996). For the Pasco/Richland/Kennewick area, the TourBook lists 20 motels with over 1,900 rooms. Assuming one construction worker per RV pad, campsite, or room, the workforce would occupy no more than 4.1 percent of the 2,416 pads, campsites, and rooms available in Franklin County (less when non-listed motels are added).

It is highly probable that visitors desiring to use transient housing would be displaced, especially on high-demand holiday weekends like the Fourth of July and Labor Day, because of:

- limits placed on the number of reservations (RV parks and motels recommend making reservations, as do many campgrounds);
- limited commuting range, since the maximum preferred commuting distances for workers range from 80 to 120 km (50 to 75 miles);
- low vacancy rates during the spring through fall of the proposed construction period;
- the prohibition of workers using USFS campgrounds;
- the substantial proportion of the accommodations that could be occupied by the non-local/construction workforce (between approximately 4 percent and 30 percent depending on the county); and
- limited seasonal availability at many public facilities (typically open for business only between Memorial Day and Labor Day).

These factors further reduce available camping sites and may encourage inappropriate discharge of sanitary wastes from RVs at roadside turnouts or rest areas, if workers cannot find adequate accommodations. Even under the assumption that some non-local/construction workers might have to settle for more distant locations for some time if they did not secure appropriate reservations for the peak weekends, the impact on transient accommodations would be major. OPL has not proposed measures to address these impacts; see the "Additional Proposed Mitigation Measures" section.

Economy and Income. An important factor in the socioeconomic impact of the proposal would be the amount and distribution of local expenditures, which consist of workers' wages and salaries, locally procured materials (notably motor fuels and aggregates), and services (e.g., engineering, equipment leasing and repair, transportation, and security). These local expenditures, and payment of sales and use taxes on taxable goods consumed by the proposal and

property taxes on the ROW and improvements, are the principal factors generating secondary employment and income in communities along the pipeline corridor.

These factors, in turn, would generate spending in the regional economy by enterprises and individuals earning income from the proposal, which would have positive multiplier effects on local income and employment. During the construction phase (estimated to last 12 months from clearing to revegetation) there would be a buildup of positive impacts as the proposal's activities expand, followed by a contraction of activity and economic stimulus as the construction work decreases.

Table 3.16-6 presents a breakdown of the proposal's construction costs allocated among the six corridor counties on the basis of pipeline mileage and construction spread location. OPL's cost estimators have projected that approximately 10 percent of the non-labor construction materials and services to be consumed onsite would be procured from suppliers located within the pipeline corridor counties. Based on the projected costs for the project, OPL used a modified IMPLAN model of Industry No. 50 (Public Utilities Construction) was used to develop projections of the impacts of procuring locally supplied goods and services, and to generate projections of multiplier effects on employment, income, output, and local taxes in each of the pipeline counties.

The other component of the IMPLAN analysis was to account for the effects of proposal workers' local spending. Purchases of food, lodging, entertainment, and other expenses, both by locally hired and non-local construction workers, would stimulate incomes and employment of local merchants and other providers of goods and services in the corridor counties. (The socioeconomics section of the ASC describes the parameters used for the IMPLAN analysis in detail.)

Overall, the direct positive industrical output impact of construction for the pipeline corridor counties' economies is projected by the ASC to be a short-term increase of about $21.5 million (in 1995 dollars) in total local business (i.e., gross sales). The initial direct infusion of proposal workers' spending $8.3 million plus procurement of locally supplied construction materials and services ($5.64 million) would recycle through the local economy, causing multiplier effects which would eventually generate another $7.54 million in indirect and induced effects. The secondary consumption spending figures reflect the estimate (shown in Table 3.16-7) that the majority of the workers would be non-local, highly skilled craftspeople hired from outside of the proposal region. Approximately two-thirds of the incremental business gains would accrue to the trade and services sectors (including transportation and utilities and government).

For the proposal region as a whole, the output multiplier for the proposal-related local spending would be 1.58 (for ever $1.00 in local area proposal-related spending, another $0.58 worth of business would be stimulated secondarily as a result of the recycling of the construction work spending). (OPL 1998, socioeconomics section.) The largest share of the economic increase would occur in Kittitas County, which has the most pipeline mileage, the Kittitas Terminal, and proposal expenditures for materials and labor. Kittitas County would accrue nearly one-half of the proposal's economic impacts. Adams County would experience the least effects, having only about 16.1 km (10 miles) of pipeline within its boundaries. The magnitude of the output multiplier effect would be greatest in Snohomish and King Counties, due to their greater depth and diversity of economic activity compared to the other four counties. As a result, a higher proportion of the proposal's and

Table 3.16-6. Preliminary Cost Estimate Distribution (in dollars) by County for the Proposal

FERC Catalog No./Project Element	Snohomish	King	Kittitas	Grant	Adams	Franklin	Total
Estimated Distribution of All Costs							
151/Land	22,022	68,425	145,500	47,976	14,768	64,649	363,358
152/Right-of-Way	807,861	2,510,140	5,337,654	1,759,983	542,421	2,371,650	13,329,709
153/API Line Pipe	1,346,435	4,183,567	8,896,090	2,933,305	904,035	3,952,749	22,216,181
154/Valves & Fittings	64,709	200,364	426,061	140,485	43,297	189,309	1,064,000
155/Pipeline Construction	2,975,706	9,245,943	19,660,914	6,482,788	1,997,974	8,735,822	49,099,148
156/Buildings & Facilities	50,000	50,000	0	0	0	150,000	250,000
158/Pumping Equipment	200,000	200,000	200,000	0	0	0	600,000
160/Kittitas Terminal Construction	0	0	9,000,000	0	0	0	9,000,000
160/Metering Equipment	200,000	0	200,000	0	0	200,000	600,000
160/Other Station Equipment	333,333	333,333	333,334	0	0	0	1,000,000
Subtotal	$5,999,842	$16,791,771	$44,199,553	$11,364,537	$3,502,513	$15,664,180	$97,522,396
State/Local Sales Tax Rates (%)	8.2%	8.2%	7.7%	7.5%	7.6%	7.7%	--
Sales Taxes	491,987	1,376,925	3,403,366	852,340	266,191	1,206,142	7,596,951
Total Cost	**$6,491,829**	**$18,168,696**	**$47,602,919**	**$12,216,877**	**$3,768,704**	**$16,870,321**	**$105,119,347**
Estimated Distribution of Local Expenditures*							
Local Wages and Salaries	1,649,858	4,239,271	9,527,079	2,769,171	727,741	3,454,655	22,367,774
Estimated Locally-Procured Construction Supplies and Services (10% of non-labor procurements)	289,686	886,651	2,755,231	617,436	208,989	878,108	5,636,101
Total Local Construction Expenditures	**$1,939,544**	**$5,125,922**	**$12,282,310**	**$3,386,607**	**$936,730**	**$4,332,763**	**$28,003,876**
Proportion of Right-of-Way							
Right-of-Way Miles	14.0	43.5	92.5	30.5	9.4	41.1	231.0
Percent of Right-of-Way	6.06%	18.83%	40.04%	13.20%	4.07%	17.79%	100.00%

* Local expenditures include construction workers' wages and salaries and locally-procured construction materials and services. Excludes land and right-of-way and sales/use taxes.
ROW = right-of-way

Source: Dames & Moore estimates

Table 3.16-7. Construction Labor Loading

Personnel	Spread #1	Spread #2	Spread #3	Total
Loading, by Craft				
Superintendent	3	1	3	7
Assistant superintendent	0	2	0	2
Office manager	2	2	2	6
Safety coordinator	1	2	1	4
Payroll clerk	2	1	2	5
Materials manager	2	1	2	5
Foreman	20	10	20	50
Mechanic	12	10	12	34
Welder	30	12	30	72
Journeyman	6	6	6	18
Operator	112	36	112	260
Welder helper	60	24	60	144
Driver	30	12	30	72
Laborer, skilled	20	10	20	50
Laborer, unskilled	75	30	75	180
Total	375	159	375	910
Estimated Local Hiring				
Operator (25%)	28	9	28	65
Welder helper (10%)	6	2	6	14
Driver (25%)	8	3	8	18
Laborer (75%)	71	30	71	173
Total Local Hires	113	44	113	270
Percent Locals of Total	30.1%	27.6%	30.1%	29.6%

Source: OPL 1998.

workers' requirements for supplies can be acquired in those two counties, and the money introduced by their expenditures would circulate longer and affect a higher ratio of businesses. (OPL 1998.)

Personal incomes (place of work impacts) of individuals, proprietors, property owners, and corporate entities would be affected positively by the construction work (OPL 1998, socioeconomics section). Personal income is one component of the value created by production of goods and services. According to the IMPLAN regional model, the $14 million in local direct procurement and worker spending would generate about $4.75 million in local personal income for employees and proprietors of local businesses serving the proposal. Their spending, in turn, would stimulate another $2.86 million in induced spending by households deriving income from proposal-related spending.

The combined effect would add approximately $7.61 million to the level of personal income in the proposal region during the construction phase.

A potential negative economic effect could be experienced by businesses supported by tourism and recreation (i.e., hotels, motels, stores). If construction workers displace tourists/recreationists in campgrounds and motels during construction, some of that income would be lost because of reduced spending by them. Construction workers' expenditures would replace some of this loss, but not all because of differing spending patterns than tourists/recreationists.

Employment. Jobs in the pipeline corridor counties would temporarily expand in response to the income stimulus, as businesses increase their payrolls to accommodate the rise in demand (over and above the direct construction jobs onsite) (OPL 1998, socioeconomics section). The IMPLAN model analysis projects that in addition to the 330 equivalent annualized full-time direct jobs, another 205 jobs would develop in the region as a result of the proposal's stimulus to the local economy. With over 900 workers involved during the middle 3 months of construction, local businesses would not be expected to make any long-term hiring decisions to meet the demands of the proposal; instead, workers and owners would put in overtime and businesses would hire temporary employees to handle the spike in demand.

Kittitas County would experience the largest increment of employment due to having the largest components of the proposal. The smaller proportion of working-age population in the rural eastern counties (Adams, Franklin, and Grant) suggests that jobs generated by the proposal for local residents would support relatively more dependents per worker household than in the western counties.

Local Government Finances. The proposal would have a positive impact on local government finances. Purchases of materials and equipment for construction would generate sales and use taxes, while the expansion of OPL's land holdings and facilities (i.e., its real and personal property) may add to local jurisdictions' assessed valuations and property taxes.

OPL estimates that sales and use taxes on the goods consumed in constructing the proposal would amount to nearly $7.6 million. Based on current sales and use tax rates in each of the corridor counties, the counties would receive the additional sales tax revenues shown in Table 3.16-6. Property taxes would be due and payable when the state determines the assessable value of the facilities improvements. Because construction is to take 1 year, no property taxes would likely be assessed during that phase.

Construction of the proposal would generate temporary increases in economic activity in the pipeline corridor counties in the form of increased business for local businesses, expanded employment, increased personal income, and additional tax revenues. The impact of construction is therefore largely beneficial from a socioeconomic perspective, and no mitigating measures are required.

Environmental Justice. Federal agencies are required to adopt as part of their mission the achievement of environmental justice as dictated by Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations.

Disproportionately high and adverse human health or environmental effects of federal agency programs, policies, and activities on minorities and low-income populations must be identified and addressed. In addition, the Order stipulates that agency programs and activities must avoid exclusion from participation, discrimination, or denying benefits to anyone because of race, color, or national origin.

Small sections of the pipeline corridor would pass through agricultural lands, some of which have hand-tended or picked crops (see Section 3.14, Agriculture). While many migrant workers tend to be of minority ancestry or of lower income levels, the small areas to be converted from labor-intensive agriculture would not substantially reduce the local employment needs of the industry. The proposal would generate some unskilled-labor jobs, with pay rates likely higher than that of the agricultural industry. The IMPLAN data do suggest that the rural and ethnically diverse eastern counties of the pipeline corridor would benefit relatively more from jobs and income generated by the proposal than would King and Snohomish Counties.

In addition, the impact to Native Americans would be negligible because the pipeline corridor does not cross the lands of the Wanapum Tribe.

Operational Impacts

Population and Demographics. Proposal operation would employ a small workforce (estimated at 10 new facility personnel and 6 to 10 local ROW personnel). Efforts would be made to hire local individuals as much as practicable, thus reducing the potential effect on the local population. Thus, impacts on populations along the pipeline corridor would be negligible.

Housing. Because operation of the proposal would only employ 16 to 20 personnel and they would be hired locally from the existing workforce, local housing would not be affected.

Economy, Employment, and Income. After completion of construction, operation of the proposal would generate a small but steady flow of income, employment, and taxes in the pipeline corridor counties. Proposal operation would employ approximately 16 to 20 full-time employees with efforts made to hire local individuals.

Operation of the proposal would have a major negative impact on Tidewater Barge Lines, Inc., the common carrier of OPL's petroleum products on the Columbia River. Tidewater employs approximately 300 people with more than 25 percent involved in the shipment of petroleum products. With 30 percent to 40 percent of the company's business directly connected with shipping OPL's products, the loss due to the proposal would be substantial. If shipments to Pasco were discontinued, Tidewater has indicated that they would be forced to lay off approximately 100 employees and discontinue petroleum shipments to Wilma (Clarkston). Indirectly, Tidewater's price of shipping grain would increase because costs are currently offset by the combined round-trip shipment of grain and petroleum products. (Hickey pers. comm.)

While the loss of income for Tidewater Barge Lines, Inc. would be a non-mitigable effect of the proposal, layoffs could be mitigated by OPL funding job placement and/or training for those whose jobs would be discontinued, as described in the additional mitigation section.

Property taxes would be due and payable when the state determines the assessable value of the facilities improvements. After operations commence, the facilities would be assessed and local jurisdictions would levy their taxes. The state would also impose other taxes on operations. OPL has prepared an estimate of the property taxes that would be levied on the proposal, summarized in Table 3.16-8. As shown, total annual property taxes for the new facility in the six corridor counties would amount to approximately $310,000. About two-thirds of the taxes would be divided among the six corridor counties on the basis of pipeline distance in each, with the remaining one-third based on other facilities located in each county including the Kittitas Terminal in particular.

Table 3.16-8. Estimated Annual Property Tax Revenues from the Proposal Listed by County

Location	Revenues
Snohomish County	$24,512
King County	56,062
Kittitas County	164,044
Grant County	26,293
Adams County	8,315
Franklin County	31,058
Total	$310,284

Source: OPL estimate.

Environmental Justice. Operation of the proposal would have little effect on minority or lower income populations. Attempts would be made to hire from the local populations, but the operational workforce would be extremely small.

A product spill along the pipeline could affect plant gathering, fisheries, and wildlife that Native Americans have historically relied upon as part of their subsistence living and for tribal ceremonies. Such a spill could result in diminished quantities available or contaminated fish and wildlife that could not be consumed. As a result, tribal members may have to conduct plant gathering, fishing, and hunting activities at a location other than at any traditional sites along the pipeline until the spill was cleaned up and it was again safe to consume local resources.

Columbia River Approach and Crossing Options. None of the alternative alignments or alternative river crossings would have significant impacts.

Cumulative Impacts. The proposal would not significantly contribute to cumulative effects from a socioeconomic perspective, primarily because of the minor to negligible level of anticipated direct and indirect impacts. The major impact of non-local construction workers on transient housing conditions would have a cumulative impact in association with similar construction projects in the vicinity of the proposal only if the recommended mitigation measures are not followed. The only significant project along the pipeline corridor planned in an undeveloped area is the planned resort complex near Roslyn. Timing of eventual construction is uncertain on both projects. It is not

known at this time whether construction periods would overlap. In addition, the current robust economy in the Portland, Oregon and Vancouver, Washington vicinity would buffer the employment loss at Tidewater Barge Lines, Inc. should the proposal be built.

3.16.2.2 No Action

Under the No Action Alternative, the proposal would not be constructed. Petroleum products would continue to be transported between western and eastern Washington by tanker truck on interstate highways and by barges on the Columbia River. The number of trips per day by each means of transport would increase over time, thus stimulating a slight increase in employment and income in the trucking and barge industries and preserving the portions of those industries that rely on shipment of petroleum products.

As identified in the “Affected Environment”, five tribes reside on relatively isolated Indian reservations located along the Pacific Ocean coast in western Washington. Under the No Action Alternative, increased ocean barging of petroleum products to meet the transportation demand would somewhat increase the likelihood of an accidental spill. Movement of petroleum products into coastal areas and on shore could affect fish and shellfish production. Even if such a spill did not lead to reduced quantities of fish and shellfish, it could contaminate them so that they could not be consumed. Also, reproductive levels of fisheries could be reduced to the point that longer-term production and quantities could be affected.

Tribal members rely upon these fisheries and shellfish more than other people because it is an integral and valued part of their cultural history. It is also a supplement to their subsistence living, resulting from the greater levels of unemployment and lower income levels they experience. Because it makes up a noticeable portion of their subsistence living, temporary removal would affect the availability of food and the quality of the diet for a number of tribal members. Such a loss might increase the need for food subsidies to some tribal members. Long-term impacts resulting from a spill could have serious effects on subsistence levels and the need for assistance. It could also affect the tribes’ ability to conduct tribal ceremonies in which fish and shellfish play an integral part.

The No Action Alternative would not allow each county to experience the positive impacts of the proposal including employment, income, and tax revenues. In particular, Kittitas County would lose the opportunity for major ongoing revenues from the Kittitas Terminal’s operation.

3.16.3 Additional Proposed Mitigation Measures

3.16.3.1 Construction Mitigation and Subsequent Impacts

The socioeconomic effects of the proposal would be predominately beneficial, in the form of temporary increases in jobs, personal income, and sales taxes during the construction phase. On any large project, the winding down of construction work can have a depressive effect upon some community economies which have built up business activity in support of the project, but it is unlikely

in this case, because of the short construction period and mobile work sites. The magnitude of each spread's work relative to the scope and depth of economic activity in the surrounding areas is unlikely to be large enough to be destablizing.

As previously stated, OPL has not proposed mitigation measures to address transient housing impacts. However, to mitigate the potential major impact of non-local/construction workers on local transient accommodations, the following alternative temporary accommodations are recommended:

- negotiating with private RV and campground owners to expand their facilities for exclusive use by the proposal workers at OPL's expense,
- renting or arranging for use of local dormitories during off-season periods (e.g., Central Washington University's student housing during the summer, non-school-year months),
- renting or arranging for use of local housing, and/or
- establishing a sewage tank and pumping system to be used by construction workers to avoid inappropriate dumping.

In addition, it is recommended that OPL develop a Transient Worker Housing Plan that includes:

- the number of housing units or RV pads actually available that non-local construction workers could use without displacing existing users, taking into account seasonal variations in vacancy rates,
- identification of other housing options (see above), quality of housing, cost of housing, proximity to work locations, availability of services, etc.,
- plans, if needed, to fund any of the above listed housing options,
- review and approval by the USFS and EFSEC to ensure workforce housing needs can be met, and
- plans for monitoring the non-local construction workforce by OPL during the construction period, and providing immediate action if needed, to ensure that illegal camping or inappropriate discharges of sanitary wastes do not occur.

If the above studies and mitigation measures are successfully implemented and housing needs are substantially met, impacts to housing would be minor to negligible.

3.16.3.2 Operational Mitigation and Subsequent Impacts

The socioeconomic effects of operation would be predominately beneficial, in the form of slight increases in employment, income, and taxes along the pipeline corridor.

The income effects on Tidewater Barge Lines, Inc. would be a non-mitigable impact, but those employees who lost their jobs could be assisted through OPL-funded job placement and/or training.

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3.17 PUBLIC SERVICES AND UTILITIES

3.17.1 Affected Environment

This section discusses the following public services and utilities: police and fire protection, hospitals and emergency medical services, schools, water supply, stormwater management, sewer, solid waste, telecommunications, and energy and natural resources. Information in this section is based on data presented in the ASC (OPL 1998).

3.17.1.1 Police

The pipeline corridor is about 372 km (230 miles) long and crosses the counties of Snohomish, King, Kittitas, Grant, Adams, and Franklin. Large sections of the pipeline corridor cross unpopulated or sparsely populated rural areas. Municipal police departments provide protection for the various communities along the pipeline corridor. The ratio of commissioned officers to 1,000 citizens for these municipalities varies from 1.54 in Ellensburg to 4.53 in Snoqualmie (Table 3.17-1). Police protection in unincorporated rural areas along the pipeline corridor is provided by county sheriff departments and the Washington State Patrol. The ratio of officers to 1,000 citizens is slightly lower in the unincorporated areas, with a range of 0.54 in Franklin County to 2.15 in Adams County. In comparison, the state of Washington has an average of 1.64 officers per 1,000 population. Table 3.17-2 provides specific information for police response capabilities for three departments near the Kittitas Terminal site.

3.17.1.2 Fire

Fire protection in unincorporated rural areas is provided by county fire protection districts. Municipal fire departments provide protection for the various communities along the pipeline corridor. Most of the county fire protection districts are volunteer districts with limited manpower and equipment (Table 3.17-3). They generally can provide, at most, adequate fire protection to residential, commercial, and farm structures. The municipal fire departments generally possess paid full-time fire fighting professionals and larger, more sophisticated fire fighting equipment arsenals.

The proposed site of the Kittitas Terminal is on the edge though just outside of the Kittitas city limits. The location is currently covered by the Kittitas County Fire Protection District #2, which has a combined staff of full-time paid employees and volunteers (Table 3.17-4). The City of Kittitas has its own volunteer municipal fire department and the City of Ellensburg has a staffed fire department.

Table 3.17-1. Police Department Staffing Levels in the Project Vicinity[a]

County/City	Population	Number of Commissioned Officers	Ratio of Officers to 1,000 Population[b]
Snohomish County	266,149[c]	166	0.62
King County	643,976[c]	629	0.98
Kittitas County	11,275[c]	22	1.95
Grant County	62,000[c]	37	0.60
Adams County	7,435[c]	16	2.15
Franklin County	42,400[c]	23	0.54
Snoqualmie	1,545	7	4.53
North Bend	(Contracts with King County Public Safety Department)		
Ellensburg	12,361	19	1.54
Kittitas	944	3	3.18
Pasco	21,645	44	2.03

[a] Data from the Washington Association of Sheriffs and Police Chiefs (1995) as cited in OPL (1998).
[b] The Washington State average is 1.64.
[c] These figures include unincorporated areas and contracted incorporated areas.

Sourec: OPL 1998.

Table 3.17-2. Police Department Staffing Levels in the Kittitas Terminal Vicinity

	Agencies*		
	Kittitas Police Department	**Kittitas County Sheriff's Office**	**Washington State Patrol District 6**
Number of Police Stations in District	4	1	Detachment office in Ellensburg, commercial vehicle enforcement detachment in Cle Elum
Number of Staff	1 supervisory position	2	2 first line supervisors (sergeants); 12 available line troopers; 8 commercial vehicle enforcement officers and 2 supervisors
Average Number of Calls Per Year and Response Time	Approx. 900 calls per year, not including traffic stops	unknown	7000 calls for service (including accidents); average response time is 20 mins.
Number of Patrol Vehicles and Officers Per Vehicle	Dept. has one car, each deputy has own car	18 vehicles, 1 officer per vehicle	14 patrol cars, 1 officer per car
Other Types of Equipment Available for Emergency Response	Local fire departments	SAR, HAM Radio, MAST, etc.	Commercial enforcement vehicles (6) for road blocks/traffic control
Current Staff, Vehicle, and Other Needs	Dept. has 3 full time officers, 1 patrol car	unknown	4 patrol cars and troopers
Anticipated Additional Staff, Vehicle and Other Needs During Project Construction	The Dept. would like to add another officer full time and possibly 2 reserves during construction. This will be a project in need of security and the Dept. does not have the manpower to cover the site 24 hours a day. Will need another fully equipped patrol vehicle to assist with the security and to enable communication.	5 people, 5 vehicles	Any manpower needed for traffic control during construction would need funding.

* Ellensburg Police Department did not respond to written request for information.

Sources: Lael, J., Police Chief, Kittitas Police Department, personal communication, May 1997; Juvett, J., Undersheriff, Kittitas County Sheriff's Office, personal communication, May 1997; Larson, Lieutenant, Washington State Patrol, District 6, personal communication, May 1997. All as cited in OPL 1998.

Table 3.17-3. Fire Districts/Departments in the Project Vicinity[a]

County	Fire District/Department	Personnel Status[b]	Protection Class[c]
Snohomish	Bothell Fire Department	P	4/7
	Snohomish County FPD #1 - Alderwood Manor	C	4/7
	Snohomish County FPD #3 - Monroe	C	>8/9
	Snohomish County FPD #7 - Clearview	C	>5/7
King	North Bend Fire Department	C	5/7
	Snoqualmie Fire Department	C	6/9
	King County FPD #10 - Issaquah/Carnation	C	5/7
	King County FPD #27 - Fall City	C	6/9
	King County FPD #38 - North Bend	C	6/9
	King County FPD #45 - Duvall	C	>5/7
	King County FPD #51 - Snoqualmie Pass	V	8/9
Kittitas	Ellensburg Fire Department	C	4/7
	Kittitas Fire Department	V	6/9
	Kittitas County FPD #1 - Thorp	V	6/9
	Kittitas County FPD #2 - Ellensburg	C	8/9
	Kittitas County FPD #3 - Easton	V	8/9
	Kittitas County FPD #4 - Vantage	V	8/9
	Kittitas County FPD #6 - Lake Cle Elum	V	8/9
	Kittitas County FPD #7 - South Cle Elum	V	>8/9
	Kittitas County FPD #8 - Lake Kachess	V	9
Grant	Grant County FPD #8 - Mattawa	V	8/9
	Grant County FPD #10 - Royal City	V	8/9
	Grant County FPD #11 - East Royal Slope	V	9
Adams	Adams County FPD #5 - Othello	C	>8/9
Franklin	Pasco Fire Department	P	5/7
	Franklin County FPD #3 - Pasco	C	>7/9
	Franklin County FPD #4 - Basin City	V	8/9

Continued

Table 3.17-3. Fire Districts/Departments in the Project Vicinity[a]

County	Fire District/Department	Personnel Status[b]	Protection Class[c]

(a) Data from personal communications with individual department fire chiefs and from the Washington State Fire Service Directory (1993).

(b) P = All Full-Time Paid; V = All Volunteer; C = Combination of Full-Time Paid and Volunteer.

(c) As rated by the Washington Surveying and Rating Bureau (1995). Fire district protection class ratings are used to evaluate fire protection availability for insurance purposes and are assessed to all municipal and rural areas by the Washington Surveying and Rating Bureau. Ratings range from 1 to 10, with class 1 representing the highest level of fire protection and class 10 the lowest level. A class 1 rating is rarely achieved. Ratings are based on four elements: the available water supply; the logistical characteristics and makeup of the district fire department; the available communications systems; and finally the fire control/safety measures taken and ordinances in effect in the particular fire district. Adequacy of fire protection indicated by a protection class rating is dependent upon the types of areas being rated. A rating of 8 or 9 is typical for a rural area. This low rating is usually due to the fact that standard fire hydrant service, required in more urban areas, is not available, and rural volunteer fire departments do not have full-time staff or formally equipped fire stations and facilities. The situation is further aggravated by access problems and reliance on volunteers who often must travel long distances to respond to calls. These factors lead to long response times and limited fire fighting ability. A rating of 8 or above, however, does not necessarily mean that fire protection is inadequate. It indicates that according to the standards of fire protection services, set up primarily for municipalities, an area is lacking in some conventional means of fire protection. Where two classifications are listed (e.g., 6/9) the following is applied: A) For Dwelling Properties the first number applies and the second number is disregarded; B) For Other Properties, (1) The first classification listed applies to properties within 600 feet of a standard fire hydrant and within 5 road miles of a recognized fire station, and (2) The second classification applies to properties located over 600 feet from a standard fire hydrant, but not over 5 road miles from a recognized fire station; C) For All Class Rated Properties (i.e., Dwellings and Other Properties), (1) Where a single Class 9 is listed, (a) Class 9 applies to properties not over 5 road miles from a recognized fire station, and (b) Class 10 applies to all other properties, (2) If the classification of an area is not listed, Class 10 applies. The symbol > indicates the existence of an Approved Tanker Operation (Dwelling Properties only).

Source: OPL 1998.

Table 3.17-4. Fire Districts/Departments in the Kittitas Terminal Vicinity

	Agencies		
	Kittitas Fire Department	Ellensburg Fire Department	Kittitas County Fire District No. 2
Number of Fire Stations	1	1	10
Number of Personnel	13	16 firefighters, 15 part-paid firefighters,2 chiefs, 2 clerical staff.	3 paid firefighters, 1 paid fire chief, 1 paid secretary, 6 resident volunteer firefighters, 85 volunteer firefighters.
Number of Personnel Typically On Duty or On Call	1	One 5-person shift with the supervisory staff available. Off-duty personnel and part-paid staff are available for call back.	1 paid firefighter on duty, 1 paid firefighter on-call, 2 resident volunteers, 1 fire chief (on duty 8 a.m.-5 p.m., M-F and on call other hours), 85 volunteer firefighters.
Average Number of Calls Per Year and Average Response Times	10 fire calls/30 aid calls; 2 to 3 mins. response time	279 fire calls and 1477 aid calls in 1996. No real seasonal peaks. Average fire response time of 6 mins.	364 calls in 1996; Seasonal peaks - spring field burns, late summer harvest grass/brush fires, winter heating, fireplaces, woodstoves; Types of calls: Vehicle EMS - 60, Other EMS - 38, Mutual Aid - 43, Structure - 30, Vehicle Fires 30, Chimney - 11, Hazmat - 5, Hay/ Grass - 97, Smoke Investig. - 24, Misc. - 26.
Number Of and Pumping Capacity of Trucks	1 pump, 1000 gpm, 1979 Ford	2 Class A 1500 GPM pumpers, 1 Class A 1250 GPM pumper, 1 100 foot aerial ladder with 1500 GPM pump.	10 1000 gal tank engines, all 750 gpm; 1 tender - 3000 gal tank with pump; 1 brush truck - 600 gal. tank, pump and foam equipped, 1 brush truck - 125 gal. tank with pump; District has signed a contract for purchase of a 1997 engine, 1000 gal. tank, 1250 GPM pump with CAFS (Compressed Air Foam System, Class A).
Major Types of Equipment Available, Including Those Needed to Fight Petroleum Fires	No equipment available	No other equipment available	District has a crawler cat with a clam shell bucket. If requested to provide protection to the terminal, the Fire District would request additional equipment either by mutual aid agreement, or by renting the equipment as needed. There is no major foam-capable equipment available in Kittitas County. County is getting a start in foam support by the purchase of a new engine. The foam system as ordered is not for oil type fires, but the appropriate system can be added to the contract for extra dollars.
How Units are Dispatched and Coordinated	911/pagers; KITTCOM Central Dispatch	All units dispatched by KITTCOM, KITTCOM is county-wide dispatch	Central Dispatch for entire county. Upon request by Dist. 2 command, can have mutual aid departments dispatch through the dispatch center. This dispatch center is used for all emergency agencies and is manned 24 hours.

Continued

Table 3.17-4. Fire Districts/Departments in the Kittitas Terminal Vicinity

	Agencies		
	Kittitas Fire Department	**Ellensburg Fire Department**	**Kittitas County Fire District No. 2**
Current Staff, Truck and Other Needs	Needs help with a larger station	Currently in need of a unit to replace the 1250 GPM engine due to age/condition. Do not have any petroleum fire fighting equipment at this time other than a small amount of AFFF foam.	Equipment: Dist. 2 has a need for additional foam equipment for oil fires (Class B or Class A Triple F). Staff: No needs Stations: There is a need for an additional unmanned station near the site of the proposed terminal. This station could be a Dist. 2/City of Kittitas Station. The current Kittitas station is not an adequate facility - it cannot accommodate the newer equipment. The closest District pumper is in the City of Kittitas. Kittitas has only one pumper. Kittitas has no paid staff. All Kittitas personnel are District volunteers, trained by District 2.
Current Staff, Truck and Other Needs (continued)			District 2 responds to all major fires in the City of Kittitas under a mutual aid agreement.
Anticipated Additional Staff, Truck, Equipment, and Other Needs During Project Operation	Need to update trucks/ equipment need more special petroleum firefighting equipment	Anticipate addition of 3-6 personnel to department within the next 5 to 10 years. If Ellensburg were to be responsible for the control of large petroleum fires, they would have to add the required specialized equipment. Due to the location of the terminal, they would not be the primary responding agency for fires. They would definitely be in line for mutual-aid.	Does not have any petroleum fire fighting equipment in the District, or in the county, to deal with any major fire, explosions, or spills.

Sources: Hink, R., Fire Chief, Kittitas Fire Department, personal communication, May 1997; Alder, S., Fire Chief, Ellensburg Fire Department, personal communication, May 1997; Baker, S., Fire Chief, Kittitas County Fire District No. 2, personal communication, May 1997. All as cited in OPL 1998.

3.17.1.3 Hospitals and Emergency Medical Services

Emergency medical services are provided in the proposal vicinity by primary response ambulance units and area hospitals. In most cases, ambulance units are operated through local fire departments, although there are a few private service providers along the six-county pipeline corridor (Table 3.17-5). About one-half of the services are located in more urban areas and have paid personnel, whereas the smaller and more rural departments have volunteer staff. Most services provide a basic life support (BLS) level of care, with only three providing advanced life support (ALS), and one providing intermediate life support (ILS). Table 3.17-6 provides a summary of the ambulance service available at the Ellensburg Fire Department, the closest ALS service provider to the Kittitas Terminal.

Acute-care hospitals can be found in many of the cities in the vicinity of the pipeline corridor and have a range of capacity from 28 beds (Snoqualmie Valley Hospital in King County) to 475 beds (Providence General Medical Center in Snohomish County) (Table 3.17-7). Each county possesses at least one acute-care hospital within the vicinity of the proposal that provides emergency medical services including receiving patients via emergency medical helicopters. The vicinity of the proposed Kittitas Terminal is served by the Kittitas Valley Community Hospital in Ellensburg, which has a 50-bed capacity and is supported by intermediate to advanced life support ambulatory services (Table 3.17-8), as well as other more distant acute care hospitals.

3.17.1.4 Schools

None of the individual school buildings in public school districts located close to the pipeline corridor are located directly adjacent to the proposed facilities. Public higher education facilities in the pipeline corridor vicinity include Edmonds Community College in Snohomish County; Bellevue Community College, Lake Washington Technical College, and University of Washington (branch campus) in King County; Central Washington University in Kittitas County; Big Bend Community College in Grant County; and Columbia Basin College in Franklin County.

In addition to these public schools, there are also several private elementary and secondary schools, colleges, and universities in the proposal vicinity. Many of these private institutions are affiliated with church or religious organizations, and most are located in the more urbanized areas along the pipeline corridor.

3.17.1.5 Water

Potable water is available to residents living in the vicinity of the pipeline corridor from a variety of sources, including municipal water departments, public utility districts, public water districts, community water associations, individual well systems, and private water companies. Many of these agencies have their own water supply sources and distribution networks. However, several of these agencies have only distribution networks and buy water wholesale from other water supply purveyors.

Table 3.17-5. Ambulance Service Providers in the Project Vicinity[a]

County	Name	Agency Type	Personnel Status	Level of Care[b]
Snohomish	Snohomish County FPD #1 - Alderwood Manor	Fire District	Paid	BLS
	Snohomish County FPD #3 - Monroe	Fire District	Paid	ALS
	Bothell Fire Department	Municipal	Paid	BLS
	Shannon Ambulance	Private	Paid	BLS
King	King County FPD #10 - Issaquah/Carnation	Fire District	Paid	BLS
	King County FPD #27 - Fall City	Fire District	Volunteer	BLS
	King County FPD #45 - Duvall	Fire District	Volunteer	BLS
	King County FPD #51 - Snoqualmie Pass	Fire District	Volunteer	BLS
	Shepard Ambulance, Inc.	Private	Paid	BLS
	American Medtech	Private	Paid	BLS
Kittitas	Kittitas County FPD #3 - Easton	Fire District	Volunteer	BLS
	Cle Elum Fire Department	Public	Volunteer	BLS
	Ellensburg Fire Department	Municipal	Volunteer	ALS
	Kittitas County PHD #2	Private	Paid	ILS
Grant	Grant County FPD #8 - Mattawa	Fire District	Volunteer	BLS
	Grant County FPD #10 - Royal City	Fire District	Volunteer	BLS
Adams	Othello Ambulance Service	Private	Volunteer	BLS
Franklin	Franklin County FPD #3 - Pasco	Fire District	Volunteer	BLS
	Pasco Fire Department	Municipal	Paid	ALS

(a) Data from the Emergency Medical Services Provider List, Washington State Department of Health (1995) as cited in OPL (1998).

(b) ALS = Advanced Life Support
BLS = Basic Life Support
ILS = Intermediate Life Support

Source: OPL 1998.

Table 3.17-6. Ambulance Services Provided by the Ellensburg Fire Department in the Kittitas Terminal Vicinity

Item	Description
Number of Ambulance Services	1 ALS ambulance service operated by Ellensburg Fire Department
Number of Staff	9 Paramedics; 7 EMT's; 2 Supervisory; 2 Support Staff; 14 Volunteer FF
Number of Personnel Typically on Duty	5 on duty; remainder on call
Average Calls and Response Time	1996 EMS Calls - 1477 (96 life threatening, 472 urgent, 529 non-urgent, 380 other) Average Response Times - Urban, 4.3 mins.; Suburban, 5.0 mins.; Rural, 13.2 mins.; Wilderness, 25.8 mins.
Number of Emergency and Rescue Vehicles	3 ambulances
Types of Equipment Available	All common hand tools including hydraulic jaws
Availability of Special Support Services	MAST helicopter from Yakima Firing Training Center; AirLift NW from Seattle
How Calls Are Received	Countywide E-911 dispatch center (KITTCOM)
Current Needs	Anticipating to add one additional ambulance in the near future
Anticipated Additional Needs During Project Operation	Unable to determine at this time

Source: Alder, S., Fire Chief, Ellensburg Fire Department, personal communication, May 1997. As cited in OPL 1998.

Table 3.17-7. Acute Care Hospitals in the Project Vicinity[a]

County	Name	Location	No. of Beds	Helipad
Snohomish	Providence General Medical Center	916 Pacific Avenue, Everett	475	Yes
	Stevens Memorial Hospital	21601 - 76th Avenue W., Edmonds	217	No
	Valley General Hospital	14701 - 179th SE., Monroe	72	No
King	Evergreen Hospital Medical Center	12040 NE. 128th Street, Kirkland	149	Yes
	Group Health Eastside Hospital	2700 - 152nd Avenue NE., Redmond	179	No
	Overlake Hospital Medical Center	1035 - 116th Avenue NE., Bellevue	257	No
	Snoqualmie Valley Hospital	1505 Meadowbrook Way SE., Snoqualmie	28	Yes
	Valley Medical Center	400 S. 43rd Street, Renton	303	Yes
Kittitas	Kittitas Valley Community Hospital	603 S. Chestnut, Ellensburg	50	Yes
Grant	Columbia Basin Hospital	200 Southeast Boulevard, Ephrata	58	Yes
	Quincy Valley Hospital	908 - 10th Avenue SW., Quincy	38	Yes
	Samaritan Hospital	801 E. Wheeler Road, Moses Lake	50	Yes
Adams	Othello Community Hospital	315 N. 14th Avenue, Othello	49	Yes
Franklin	Our Lady of Lourdes Health Center	520 N. 4th Avenue, Pasco	132	Yes

[a] All hospitals in this listing have emergency rooms and provide emergency medical services.

Source: Data from the Directory of Acute Care Hospitals, Washington State Department of Health (1995) as cited in OPL 1998.

Table 3.17-8. Acute Care Hospitals in the Kittitas Terminal Vicinity

Item	Agencies*				
	Kittitas Valley Community Hospital, Ellensburg	Columbia Basin Hospital, Ephrata	Samaritan Hospital, Moses Lake	Providence Yakima Medical Center, Yakima	Yakima Valley Memorial Hospital, Yakima
Number of Staff	1 emergency room physician in hospital 24 hours a day, 365 days a year. 26 physicians on staff. 70 nursing personnel on duty during regular business hours.	6 MD's - 4 Mid level PA - ARNP.	Physicians: 51 Nurses: 87	Medical Staff - 200; Nurses (all shifts) - 235.	318 physicians, 258 nurses.
Number of Personnel Typically On Duty	Typically 135 on-duty staff members during regular hours. During off-hours there are only three depts. that don't have in-house personnel on-duty; imaging services, pharmacy, and housekeeping. There is one on-call person for each of these three departments with more available in an emergency.	15-25 on-duty business hours. 10 on-duty after hours. 5 on-call various capacities.	On-Duty - Approx. 107 FTEs per day over 3 shifts. On-Call - Approx. 20-25 people per day.	80 RN's and techs with ancillary support staff on-call system available.	Personnel on-duty: 365; on-call: 1152 (for disasters). Emergency Dept.: on duty: 2 phy., 6 nurses; on-call 11 phy., 22 nurses.
Types and Average Numbers of Services Provided	ER volumes average 650 per month over the course of the year. Higher volumes seen in the summer months. Hospital is a designated Level IV trauma facility and sees approx. 50 multi-system (seriously injured) trauma patients per year.	Primary Care/ Emergency - Trauma. 200 ER pts/month 2-3 ER trauma/week.	Service - 24 hours a day, 7 days a week physician staffed ER service. Avg. # pts. per year - 148 critical care patients. Percent use of ER services daily, seasonally - Unlimited capacity at current levels, i.e., 1000 visits per month.	Full service hospital; Trauma; Advanced Cardiac Care; Average daily emergency census - 85; Level III Trauma Service shared with Yakima Valley Memorial Hospital.	Types of services: full service hospital. Trauma Center Level III. 1996 trauma patients totaled 467, other patients totaled 34,744.
Patient Referrals	A majority of patients transferred/referred out are sent to Yakima, with the exception of multi-system trauma, which go to Seattle. Non-trauma referrals not sent to Yakima primarily go to Seattle.	Samaritan Hospital - Moses Lake, Central Washington Hospital - Wenatchee, SHMC - Spokane.	Referrals to Spokane, Wenatchee, and Seattle.	Transfers to Harborview in Seattle.	Providence-Yakima MC or Harborview (Seattle).

Continued

Table 3.17-8. Acute Care Hospitals in the Kittitas Terminal Vicinity

	Agencies*				
Item	**Kittitas Valley Community Hospital, Ellensburg**	**Columbia Basin Hospital, Ephrata**	**Samaritan Hospital, Moses Lake**	**Providence Yakima Medical Center, Yakima**	**Yakima Valley Memorial Hospital, Yakima**
Special Support Facilities	Airlift Northwest (Seattle) is primary air ambulance service. The hospital has a helipad on-site. Serious burn patients are airlifted to Harborview in Seattle. In major disasters, airlift services from Spokane and Wenatchee would likely be used, as well as MAST (military) helicopters.	Rotary Wing - Medstar Fixed Wing - Medstar Fixed Wing - Airlift NW Burn taken to Harborview MC or SHMC in Spokane.	Special Services: Air Ambulance - Spokane; Burn Care - Harborview, Seattle; Neuro-trauma - either Spokane or Seattle.	Burn treatment - Harborview, Seattle; Air Ambulance - Airlift NW, Seattle; Local Support (Yakima Firing Center) MAST Helicopter; Local advanced life support - ground transport - two ambulance services.	MAST helicopters and Air Ambulance (from Seattle). Harborview is burn center.
How Calls Are Received	KITTCOM handles 911 calls and dispatches EMS personnel.	E-911 System for Grant County and Grant County Disaster preparedness.	Calls received /coordination: Through ER Manager, House Director, or Physician.	City wide disaster program - Medical control facility that coordinates major catastrophic events and multiple casualty incidents.	Emergency Medical System in place to call emergency facilities; follows established disaster protocols.
Current Needs	None at this time.	Don't know.	Current Staff: 385 people.	Current staff greater than 1000.	Current staff: 1152 (RN's 328, LPN's 58).
Anticipated Additional Needs During Project Operation	Anticipated additional staff would depend on injuries. Triaging would be done by City of Ellensburg Ambulance paramedics at the scene and those paramedics would decide where the injured were sent for treatment. Victims sent to KVCH would be triaged by the emergency dept physician on duty and appropriate decisions made as to additional staff needing to be brought in. KVCH has a Disaster Plan that would be activated in the event of a large number of victims being brought to the facility.	Don't know.	Currently there are no needs for explosion/fire treatment equipment. Currently there is no additional staff anticipated. If specific equipment is thought to be needed, funding may be required.	Would need to look at a coordinated effort with Airlift NW and local ambulances to transport large numbers of victims to Burn Center; Identify Harborview Hospital burn limit capacity and triage system for care of mass casualty victims.	All staff is considered on-call for disasters.

* Quincy Valley Hospital in Quincy did not respond to written request for information.

Sources: Jensen, E., Administrator, Kittitas Valley Community Hospital, personal communication, May 1997; Beach, A., Administrator, Columbia Basin Hospital, personal communication, May 1997; Baldwin, K., Administrator, Samaritan Hospital, personal communication, May 1997; Hood, B., Administrator, Providence Yakima Medical Center, personal communication, May 1997; Linneweh, R., Administrator, Yakima Valley Memorial Hospital, personal communication, May 1997. All as cited in OPL 1998.

Major public water supply providers in areas crossed by the pipeline corridor include the following: Alderwood Water District and Cross Valley Water District in Snohomish County; Carnation Water Department, King County Water District #127, Snoqualmie Water Department, North Bend Water Department, and Sallal Water Association in King County; Kittitas County Water Districts #3 and #5, and Kittitas Water Department in Kittitas County; Beverly Water District, Royal City Water Department, Royal Water District, and Port of Royal Slope in Grant County; Othello Water Department in Adams County; and Pasco Water Department in Franklin County.

Water for agricultural purposes is available in the vicinity of the pipeline corridor from public agencies, such as irrigation districts, and from private well systems. Irrigation water is distributed via closed pipelines or open canals. Major irrigation water supply providers in areas crossed by the pipeline corridor include the Cascade Irrigation District and Kittitas Reclamation District in Kittitas County; East Columbia Basin Irrigation District in Adams County; and South Columbia Basin Irrigation District, Smith Canyon Irrigation District, and Franklin County Irrigation District #1 in Franklin County. Further detailed discussions of water and water supply issues can be found in Section 3.6, Water.

3.17.1.6 Stormwater

In urbanized portions of the pipeline corridor, stormwater is handled by storm sewer systems or onsite collection and dissipation systems. In lesser developed areas, stormwater handling facilities are usually limited to grassy swales along roadways, and in some instances retention or detention ponds. Large portions of the pipeline corridor traverse undeveloped and/or sparsely populated areas with no formal stormwater handling facilities.

3.17.1.7 Sewer

In urbanized portions of the pipeline corridor, sewage and wastewater treatment and disposal are handled by underground sanitary sewer systems and sewage treatment facilities. Sewage and wastewater treatment plants near the corridor are located in Snoqualmie and North Bend in King County; Hyak, Cle Elum, and Kittitas in Kittitas County; Wanapum Village and Royal City in Grant County; and Pasco in Franklin County.

In less developed rural and agricultural areas, sewage treatment and disposal are handled onsite with septic tanks and associated drainfields. Large portions of the pipeline corridor traverse undeveloped and unpopulated areas with no centralized sewage treatment and disposal facilities.

3.17.1.8 Solid Waste

Solid waste collection services are available to residents living in urbanized areas near the pipeline corridor from a mix of county, municipal, and private agencies. Many communities contract with private haulers to provide residents with garbage collection and recycling services. Solid waste is typically hauled to large regional landfills operated at the county level, although there are also

smaller municipal and private transfer stations and landfills. Major landfills near the pipeline corridor include the Snohomish Regional Landfill, north of Clearview in Snohomish County; Cedar Hills Regional Landfill, south of North Bend in King County; Ryegrass Landfill, west of Vantage in Kittitas County; Ephrata Landfill, south of Ephrata in Grant County; Bruce Landfill, east of Othello in Adams County; and New Waste Inc. Landfill, east of Pasco in Franklin County.

Much of the less developed rural and agricultural portion of the pipeline corridor is outside of the coverage area of solid waste collection service providers. Residents of these areas either transport their refuse to established solid waste transfer stations, or burn it onsite.

3.17.1.9 Telecommunications

Telephone and telecommunication services are available to residents along the pipeline corridor from several service providers. The corridor crosses the service areas of the following local telephone service providers: GTE Northwest, US West Communications, PTI Communications, Inland Telephone Company, and Ellensburg Telephone Company. Through modern interconnected communications networks, long-distance telephone and other telecommunication services are available from up to 275 separate service providers in the six-county area. Among these companies, AT&T Communications, Sprint Communications, and MCI Telecommunications have the largest customer base and the largest installed network of underground lines and above-ground service facilities. In addition, World Communications Inc. (WorldCom) and AT&T have installed fiberoptic communications lines along some of the same ROW as the proposed pipeline, including through Snoqualmie Pass Tunnel.

3.17.1.10 Energy and Natural Resources

Energy and natural resource services are available from a variety of providers along the pipeline corridor, depending on the resource. Electrical power is provided by local public utility districts, electrical cooperatives, or larger power companies. The pipeline corridor crosses the service areas of the following electrical power providers: Snohomish County Public Utility District, Puget Sound Energy, Tanner Electric Cooperative, Kittitas Public Utility District, Grant County Public Utility District, and Big Bend Electrical Cooperative. Puget Sound Energy has an overhead electrical powerline along some of the same ROW as the proposed pipeline. Other energy and natural resources that are available through local providers include fossil fuels, water (see the "Water" section above and Section 3.6, Water), aggregate gravel, sand, cement, and other building materials.

3.17.2 Environmental Consequences

3.17.2.1 Proposed Petroleum Product Pipeline

As described in Chapter 2, the proposal construction workforce would be split into three construction spreads. Spread 1 would construct the western portion of the project, Spread 2 would

construct the central mountainous portion, and Spread 3 would construct the eastern portion. The construction workforce peak for each spread would include 375 workers for Spread 1, 159 workers for Spread 2, and 375 workers for Spread 3. Approximately 70 percent of the proposal construction workers (640 workers for the three spreads) would come from outside the state.

Because most of the construction would last approximately 12 months, few of the out-of-state workers would be expected to bring families with them. With favorable weather, the expected duration of construction at any one location along the pipeline corridor is no more than 10 days.

The completed proposal would employ at least 10 people: four employees added to OPL's Renton facility for control and monitoring of products movements, four employees to staff the Kittitas Terminal to handle incoming tanker truck loading activities, and two employees at the Pasco Delivery Facility. An additional 6 to 10 OPL employees would be hired locally and would be responsible for maintenance of the pipeline and ROW.

With no extensive demand on any public service or utility anticipated, as illustrated above, and with the implementation of measures to reduce traffic impacts (see Section 3.10, Traffic and Transportation), the overall impact to most public services and utilities is expected to be minor and short-term. Measures to be implemented as part of the proposal are included in Appendix C.

Construction Impacts

Police. During construction, the influx of out-of-area construction workers into neighboring communities and the construction activities themselves may result in a minor and temporary increase in the demand placed on local police departments. Due to the short-term nature of the construction activities at any one location along the pipeline corridor (10 days or less), this impact is expected to be negligible.

Traffic controls and detours associated with construction in and near the communities of Snoqualmie, North Bend, Kittitas, and Pasco may alter access routing for police vehicles. However, the project would include consideration of emergency vehicle needs. In addition, coordination with local police departments would occur before and during the construction phase. Local police departments would be kept abreast of construction progress, and contingency plans would be developed to guide activities in the event of an emergency. The impact of construction on local police departments is therefore anticipated to be negligible.

Fire. Construction activities may result in a minor and temporary increase in the demand placed on the staff of local fire departments and fire protection districts. The same factors applied to police protection would be implemented with regard to fire protection including coordination with local fire protection providers and route access alterations for emergency vehicles. In addition, stringent construction health and safety measures would be enforced to reduce the potential for accidents, particularly during the welding phase. Contingency plans would be developed to guide activities in the event of a fire emergency.

Due to the small number of fire incidents that might occur during the construction phase of the proposal and the short-term nature of construction at any one location, the impact on local fire protection providers is therefore anticipated to be negligible.

Hospitals and Emergency Medical Services. A minor and temporary increase in the demand on local emergency medical service providers and local hospitals may occur during construction. The 12-month construction phase would require approximately 700,000 individual worker hours of labor. Based on Department of Labor and Industries data for similar pipeline construction projects, an expenditure of this many worker hours is expected to generate approximately 130 claims. (A claim is defined as a request for medical treatment and/or benefits.) Averaged over the 12-month construction period, this calculates to 10 claims per month over the six-county proposal area.

The same factors regarding coordination and emergency vehicle access needs would be applied to medical service providers as described above for police and fire protection. When these factors are taken into consideration, along with the stringent health and safety measures described under fire protection, the impact of proposal construction on local emergency medical service providers and local hospitals is expected to be minor.

Schools. Due to the short duration and mobile nature of the construction activities, few if any of the out-of-area construction workers are expected to be accompanied by families. School enrollments are therefore not expected to be affected by the influx of out-of-area construction workers into nearby communities. Students and staff at schools near the pipeline corridor may experience disturbances to their daily routines due to noise and dust generated by construction. Due to the short-term nature of the construction activities at any one section of the pipeline corridor, this impact is expected to be negligible.

Traffic controls and detours associated with construction in and near the communities of Snoqualmie, North Bend, Kittitas, and Pasco may cause access problems for school buses. However, the project would also include consideration of school buses, and the impact of construction on these vehicles is anticipated to be negligible.

Water. During proposal planning, the location of all buried water lines and irrigation canals and facilities in the vicinity of the pipeline corridor would be determined. Construction methodology and activities would be planned and coordinated with water supply service providers to avoid damage to existing lines and facilities. Contingency plans would also be established to guide activities in the event of water contamination or damage to existing lines and facilities. Construction-related impacts to existing water supply lines, canals, and facilities are therefore expected to minor.

During construction, approximately 5.7 million liters (1.5 million gallons) of water would be used for hydrostatic testing of the pipeline and 15.9 million liters (4.2 million gallons) for testing the tanks at the Kittitas Terminal. This water would be obtained from the Snoqualmie River, City of North Bend, Cascade Irrigation Canal, and the Wahluke Branch Canal. Hydrostatic test water would be routed through the pipeline and reused as much as practicable to reduce the total water demand for this process. Prior to discharge, hydrostatic test water would be analyzed and discharged into temporary sediment traps. Hydrostatic test water would then be released at a low enough rate to

minimize impacts to the receiving water body. Test water would be discharged at the Stampede Pump Station site, Kittitas Terminal site, and at the Pasco Delivery Facility. Due to the relatively low volume of water required, this process is expected to have a minor effect on local availability of potable or irrigation water.

Stormwater. During construction, site alteration, earth movement, and compaction would heighten the potential for increased stormwater runoff, erosion, and sedimentation. This potential would be important where the pipeline crosses natural and artificial drainages. Erosion and sedimentation potential would be reduced by the implementation of the Department of Ecology's BMPs (see Appendix C). Implementation of construction methodologies to reduce stormwater runoff (including BMPs) is expected to reduce runoff volumes to levels which can be adequately handled by installed facilities, thus having a minor impact.

Sewer. During proposal planning, the location of all buried sewer lines, septic systems, and facilities in the vicinity of the pipeline corridor would be determined. Construction methodology and activities would be planned and coordinated with local sewer utilities to avoid damage to existing lines and facilities. Contingency plans would also be established to guide activities in the event of damage to existing lines and facilities. Construction-related impacts to existing sewer lines, septic systems, and facilities are therefore expected to be negligible.

Solid Waste. During construction, OPL would contract with a solid waste collection contractor for removal of solid waste generated onsite. The volume of solid waste generated is not expected to be large for construction. The solid waste generated would be comprised mainly of spent construction materials. Brush and other vegetation cleared from the ROW would either be burned, chipped onsite, or hauled offsite to an approved disposal facility. Soil removed during trenching operations would be used for backfilling the pipeline, for erosion control, and landscaping. Merchantable timber would be sold. No hazardous waste would be generated by the construction activities. Therefore, solid waste impacts are anticipated to be minor.

Telecommunications. During the planning of the proposal, the location of all overhead and buried communications lines and facilities (e.g., the WorldCom and AT&T fiberoptic lines in the ROW) and others in the vicinity of the pipeline corridor would be determined, including underground fiberoptic cables. Construction methodology and activities would be planned and coordinated with communication service providers to avoid damage to existing lines and facilities. While no service interruptions or pipeline corridor changes are anticipated due to the location of underground communication lines, contingency plans would be established to guide activities in the event of damage to existing lines and facilities. Construction-related impacts to existing communication lines and facilities are therefore expected to be negligible.

Energy and Natural Resources. Construction-related impacts on energy and natural resources are considered to be relatively minor. The largest non-renewable energy resource consumed would be fossil fuels, in the form of diesel and gasoline. To a much lesser extent, electricity would also be consumed. Measures taken to avoid impacts to the electrical lines during construction would be the same as those discussed for telecommunications, above. The main non-renewable natural resources would be steel (coming from iron ore), gravel (from existing gravel pits), and concrete (coming from aggregate gravel, sand, and cement quarries and pits).

Energy would be consumed by construction vehicles, trucks, mobile equipment, and tools operated in the actual construction of the pipeline, pump stations, and the Kittitas Terminal. During the 12-month period encompassing construction and post-construction activities such as inspection, the estimated average daily usage of diesel fuel would be 28,804 liters (7,600 gallons), with a peak daily usage of 57,608 liters (15,200 gallons). The estimated average daily usage of gasoline during construction would be 15,539 liters (4,100 gallons), with a peak daily usage of 31,078 liters (8,200 gallons). These fossil fuels would be obtained from local bulk petroleum distributors. These distributors have adequate capacity to accommodate the fuel needs of this proposal.

The proposal would be constructed using materials, such as steel, that require energy and natural resources for fabrication. Energy would also be required to transport these materials from the fabrication point to the ROW. Data for energy and natural resource usage during this activity are not readily available; however, such consumption would predominately be in the form of electricity and fossil fuels, and various minerals and metallic ores.

The quantities of aggregate gravel, sand, and cement required would not generally be considered "large" (Table 3.17-9). These materials would be used primarily for construction of equipment and building foundations. Aggregate gravel, sand, and cement would be supplied by local venders. Soil excavated during trenching operations would be the primary source for backfill material for the pipeline. There are local sources of the needed materials that are believed to be adequate along the pipeline corridor. Other building materials, equipment, and operational commodities would be purchased from equipment and material suppliers.

Operational Impacts

Police. During operation, the pipeline would be buried in a clearly marked ROW. The Kittitas Terminal would have an integrated security and fire detection/suppression system. Police response capabilities would be provided by the four police departments in the vicinity of the Kittitas Terminal. OPL would provide onsite security during operation of the Kittitas Terminal, and is not intending to rely on the Kittitas Police Department to provide 24-hour-a-day coverage. OPL is in the process of negotiating a services agreement with the City of Kittitas, and this agreement would determine the services that would be provided and the funding mechanisms. It is anticipated that the Kittitas Police Department would provide response to criminal activities should they occur at the site. These factors, coupled with the relatively small number of employees associated with every-day maintenance and operation of the pipeline, would minimize additional demands placed on local police departments. The operational impacts of the proposal on local police departments are therefore anticipated to be negligible.

Fire. As with police protection, the every-day operational impacts of the proposal on fire protection providers are anticipated to be negligible due the clearly marked ROW, the integrated security and fire detection/suppression system at the Kittitas Terminal, and the relatively small number of employees associated with maintenance and operation.

The three fire departments in the vicinity of the Kittitas Terminal are not currently equipped to respond to a major petroleum fire (Section 4.1, pages 45-56 of OPL's ASC describe the potential size and effect of such a fire). OPL would have adequate fire detection and suppression equipment

Table 3.17-9. Estimated Construction Material Quantity

County	Mile Post*	Pump Station	MLV Site	Length (LF)	Concrete: Cement (ton)	Concrete: Sand (ton)	Concrete: Gravel (ton)	Graded Soil (cy)	Crushed Stone (cy)	Asphaltic Concrete (tons)	Clay Liner (cy)	Building (sf)	Fence (lf)	Structural Steel (ton)	Padding (cy)	Precast Concrete Building (8'x8'x9')
Snohomish	0 - 14															
Thrasher Pump Station		1			42	89	156		932			3,120	2,104	3		
Remote Valve			2		2	3	6					128	200			2
Pipeline				71,280												
Subtotal		**1**	**3**	**71,280**	**44**	**92**	**162**		**932**			**3,248**	**2,304**	**3**		**2**
King	14 - 57.5															
North Bend Pump Station		1			40	80	150		100			3,120	1,430	2		
Remote Valve			8		2	3	6					512	800			8
Pipeline				224,400											25,000	
Subtotal		**1**	**8**	**224,400**	**42**	**83**	**156**		**100**			**3,632**	**2,230**		**25,000**	**8**
Kittitas	57.5 - 150															
Stampede Pump Station		1			30	63	110		722			3,120	820	3		
Kittitas Terminal		1			683	1,450	2,538	7,000	296	1,417	3,117	5,588	4,403	67		
Remote Valve			7		3	6	10					448	700			7
Pipeline				469,920											17,000	
Subtotal		**2**	**7**	**469,920**	**716**	**1,519**	**2,658**	**7,000**	**1,018**	**1,417**	**3,117**	**9,156**	**5,923**	**70**	**17,000**	**7**
Grant	150 - 180.5															
Beverly-Burke Pump Station		1			15	31	54		833			3,120	900	3		
Remote Valve			4		4	8	14					256	400			4
Pipeline				171,600												
Subtotal		**1**	**4**	**171,600**	**19**	**38**	**68**		**833**			**3,376**	**1,300**	**3**		**4**

Continued

Table 3.17-9. Estimated Construction Material Quantity

County	Mile Post*	Pump Station	MLV Site	Length (LF)	Concrete Cement (ton)	Concrete Sand (ton)	Concrete Gravel (ton)	Graded Soil (cy)	Crushed Stone (cy)	Asphaltic Concrete (tons)	Clay Liner (cy)	Building (sf)	Fence (lf)	Structural Steel (ton)	Padding (cy)	Precast Concrete Building (8'x8'x9')
Adams	180.5 - 189.9															
Othello Pump Station		1			15	31	54		819			3,120	890	3		
Remote Valve			1		1	2	4					64	100			1
Pipeline				44,800												
Subtotal		1	1	44,800	16	33	58		819			3,184	990	3		1
Franklin	189.9 - 231 230															
Pasco Facility		1			25	45	75		834			2,520	900	3		
Remote Valve			1		1	2	4					64	100			1
Pipeline				216,480												
Subtotal		1	1	216,480	26	47	79		834			2,584	1,000	3		1
Total		6	23	1,196,560	861	1,813	3,180	7,000	4,536	1,417	3,117	25,180	13,747	83	42,000	23

*Mileposts are approximate.

Source: OPL 1998.

onsite at the terminal to respond to a limited facility fire or storage tank fire. OPL would only expect responding fire personnel to establish a safety perimeter around the facility and manage access and evacuation if necessary until OPL terminal staff arrived. OPL personnel would arrive quickly in response to such an emergency. OPL would coordinate with the responding emergency service and advise and assist during the emergency. Mutual aid agreements would provide equipment, materials, and training for local fire departments or emergency responders. Should any single event tax the suppression system beyond its capabilities or beyond the capabilities of OPL or other local resources, OPL would have immediate access to professional fire fighting firms located in California or Texas who would have the resources and expertise to manage a large tank/facility fire. This is the same fire suppression backup resource that is available to refineries and fuel storage facilities, and provides personnel, foam, and other equipment in large quantities within 3 hours.

Where needed, OPL would provide equipment and materials and sponsor training for local fire departments or emergency responders. The facility would be required to have an approved Spill Prevention, Control, and Countermeasure (SPCC) plan before operation which would specify response resources and the role of various responding agencies.

Hospitals and Emergency Medical Services. Employment projections for the operational phase of the proposal indicate that approximately 20,000 individual worker hours would be required annually for operations at the Kittitas Terminal and maintenance along the pipeline corridor. Based on Labor and Industries data for similar industries, this annual labor expenditure is expected to generate one claim per year. When taken in combination with the same factors listed for police and fire protection services above, the demand placed on local emergency medical service providers would be minimal. Therefore, operation would have negligible impact.

Schools. During operation, four employees would be added to the Renton facility, four employees would staff the Kittitas Terminal, two employees would staff the Pasco Delivery Facility, and approximately six to ten other employees would be added locally along the line for pipeline and ROW maintenance. Area schools have sufficient capacity to accommodate this small increase in population and subsequent potential increase in enrollment. Other operational and maintenance activities at the pump stations, Kittitas Terminal, Renton Control Center, and on the pipeline corridor would be localized to these facilities and are not expected to affect local schools and educational facilities. Thus, a negligible impact would result.

Water. Operational activities at the pump stations, Kittitas Terminal, Pasco Delivery Facility, and on the pipeline corridor would be localized to these facilities, and are not expected to have an effect on local water supply providers. Proposal-related potable water needs would be limited to that required for domestic consumption at the Kittitas Terminal, Thrasher Station, North Bend Station, and Pasco Delivery Facility. The connections at Thrasher would consist of a water tap to the existing municipal system. The connections at North Bend would consist of an existing well.

There are no municipal system connections available at the Stampede, Beverly-Burke, and Othello Pump Station sites at the present time. Because these facilities would be constructed at some future date, detailed plans would be developed and submitted to EFSEC for approval when OPL determines that the additional stations are required.

Due to the small number of employees who would staff the Kittitas Terminal (four total) and Pasco Delivery Facility (two total), the volume of water required for operation is expected to have a negligible impact on the local water supply service provider. Maintenance activities at proposal facilities located near water lines and irrigation canals would be coordinated with individual service providers to prevent water contamination or damage to existing water supply facilities. (See Section 3.6, Water, for a further detailed discussion of water and water supply issues.)

Stormwater. During operation, increased impervious surface area is expected to have a negligible impact on the existing stormwater flow patterns of the proposal area.

Sewer. Operational activities at the pump stations, Kittitas Terminal, Pasco Delivery Facility, and on the pipeline corridor would be localized to these facilities and are anticipated to have a negligible impact on existing sewage treatment and disposal systems.

Proposal-related sewer needs would be mainly limited to that generated by operations at the Kittitas Terminal and Pasco Delivery Facility. Sewage generated by the terminal would likely be disposed of in the sewage treatment plant in Kittitas. Current projections indicate the anticipated sewage flow volume from the terminal would be approximately 3.8 liters (1 gallon) per minute. The Kittitas sewage treatment plant has adequate capacity to accommodate this additional demand. (Varela & Associates 1996 in OPL 1998.) The Pasco Delivery Facility would generate very limited quantities of sewage with only two people and no impacts to local facilities would occur.

The pump stations would be unmanned, automated facilities. These stations may, however, have lavatory facilities for workers performing periodic maintenance. The two western Washington stations (Thrasher and North Bend) may be connected to an existing sewer system if an onsite septic system is not feasible. An existing sanitary sewer system lies approximately 460 m (1,500 feet) away from the proposed location of the North Bend Station. If these stations are connected to an existing sewer system, the anticipated sewage flow volume would be lower than that of an average single-family residence. The three eastern Washington stations (Stampede, Beverly-Burke, and Othello) are each located in an area that would permit an onsite septic system.

Any additional sewage or wastewater generated by the pump stations during periodic maintenance would be collected and disposed of in an approved disposal facility. Maintenance activities at proposal facilities located near underground sewer lines and facilities would be coordinated with local sewer utilities to prevent damage to these facilities.

Solid Waste. During operation, OPL would contract with a solid waste collection contractor for removal of solid waste generated onsite. The volume of waste is not expected to be large for operation of the proposal and thus would have a negligible impact.

Telecommunications. Operational activities at the pump stations, Kittitas Terminal, and on the pipeline corridor would be localized to these facilities, and are anticipated to have a negligible impact on local communications service providers. Maintenance activities at proposal facilities located near communications lines would be coordinated with individual service providers to prevent damage to existing communications facilities.

Energy and Natural Resources. The main resource consumed during operation, and the primary energy source, would be electricity. A detailed description of projected energy utilization requirements for the 30-year operating period assumed for the proposal can be found in the energy and natural resources section of the ASC (OPL 1998). The individual sources and uses of electricity are as follows.

The Snohomish County Public Utility District is the energy supplier in the area of the proposed Thrasher Station. Puget Sound Energy has a power line near the proposed site and no new transmission line poles would have to be constructed to serve the site. Puget Sound Energy and the Snohomish Public Utility District have a reciprocity agreement that allows service to customers outside of normal service areas, and services OPL's existing Woodinville Station in a similar manner. The Snohomish Public Utility District's nearest substation is at Turners Corner, approximately 2.4 km (1.5 miles) east of the Thrasher Station. The Snohomish Public Utility District would build a substation on the pump station property and enter into an agreement with Puget Sound Energy to tap its transmission line which crosses the pump station property. The Thrasher Station would have an annual power usage ranging from 16.6 million kilowatt-hours (kWh) to 24.7 million kWh.

Puget Sound Energy and Tanner Electric are the suppliers in the area of the proposed North Bend Station. The proposed pump station would have an annual usage of 3.0 to 13.5 million kWh during the 30-year operation period and could be served either by Puget Sound Energy or Tanner Electric Cooperative, both of which have substations in the vicinity of the site. Puget Sound Energy has a substation approximately 60 m (200 feet) from the site with adequate capacity to serve the station. Tanner's new South Fork Substation is located about 1.6 km (1.0 miles) northwest of the pump station. In either case, new dedicated overhead or underground 4 kilovolt (kV) service lines would have to be extended to the station property.

Puget Sound Energy and the Kittitas County Public Utility District #1 are suppliers in the area of the proposed Stampede Station. Puget Sound Energy has an existing transmission line immediately adjacent to the site. Puget Sound Energy would build a new dedicated 4 kV feeder line and a new substation and tap their existing Cle Elum-Hyak 115 kV transmission line. Kittitas County Public Utility District #1 would serve the pump station by constructing a 115 kV line to a 12.5 kV substation and tapping Puget Sound Energy's 115 kV transmission line in the vicinity of the intersection of the Stampede Pass Road and the railroad ROW (Iron Horse Trail). This location is just north of the Stampede Pump Station. A short underground distribution line would be constructed from the substation to the pump station stepdown transformers. Over the 30-year operation period, the Stampede Station would have an annual power usage ranging from 0.018 to 13.3 million kWh.

Puget Sound Energy and Kittitas County Public Utility District #1 are the suppliers in the area of the proposed Kittitas Terminal. There are no defined territorial boundaries in this area and either Puget Sound Energy or Kittitas Public Utility District could provide service to the terminal. Puget Sound Energy has a substation with adequate capacity on the south side of the city's main commercial area, about 1.2 km (0.75 miles) to the north and west of the terminal property. If Puget Sound Energy were the supplier, they would build either two dedicated 4 kV underground feeder lines from the Kittitas Substation, or a new tap of the Taunton-Kittitas 115 kV line and a dedicated 115-4 kV substation constructed on the terminal property. Kittitas County Public Utility District #1 has a 34.5 kV transmission line running west to east through the City of Kittitas, about 1.6 km (1.0 mile)

north of the station property. If Kittitas County Public Utility District #1 were the supplier, they would build a 34.5-12 kV substation near the 34.5 kV transmission line, tap into their 34.5 kV transmission line, build an underground 1.6 km (1.0-mile) transmission lateral to the terminal, and build a distribution substation on the terminal property. The entire Kittitas Terminal, including the station and the rack, would have an annual power usage ranging from 11.3 million kWh initially to 17.1 million kWh by the 30th year of operation.

The Beverly-Burke Station would have an annual power usage of 0.018 million kWh over its 30-year operation period. Electrical power would be supplied by the Grant County Public Utility District. The Public Utility District has a 13.8 kV transmission line paralleling Beverly-Burke Road a few hundred feet from the site. Grant County Public Utility District would construct a short distribution tap line (either overhead or underground) from the existing 13.8 kV distribution feeder to a utility substation (step down transformer) on the pump station site. Grant County Public Utility District has found that their existing Jericho substation has sufficient capacity to serve the pump station load and no modifications are required.

The area where the Othello Station is proposed is served by the Big Bend Electrical Cooperative. Big Bend has a transmission line along State Route 24 approximately 0.8 km (0.50 mile) south of the station property. Big Bend would tap into their transmission line, build a new 0.8 km (0.50-mile) line from State Route 24 to the site, and build a distribution substation (stepdown transformers) on the station property. The Cooperative currently has adequate capacity in the existing transmission line to serve the site from the Eagle Lake Substation located about 8.0 km (5.0 miles) south of the pump station. The annual power usage by the Othello Station would be approximately 0.018 million kWh over its 30-year operation period.

The proposed Northwest Terminalling site at Pasco currently has power and no new upgraded transmission lines would be required for OPL facilities. Power would be provided by installing a second distribution transformer and service at the existing facility.

All block valves would require power. Sites for block valves have tentatively been identified, and would be served by a variety of suppliers. Sites were selected with power availability in mind, loads are very small, and there are no special power requirements. Hence, no difficulty in securing service is anticipated.

There would also be minor consumption of various metals, petroleum-based lubricants, paints, and selected chemicals as the pipeline, pump stations, and Kittitas Terminal are operated and maintained. Other energy and natural resource usage is expected to be negligible.

Columbia River Approach and Crossing Options. Energy impacts would be essentially the same for all segment options and Columbia River crossing options.

Cumulative Impacts. Operation of the project would consume electricity for powering the Kittitas Terminal and pump stations. Annual power usage would range from approximately 31.5 million kWh initially to 68.6 million kWh by the 30th year of operation. In addition, there would be minor amounts of various non-renewable natural resources consumed during operation and maintenance activities. The consumption rate of these resources would not be at levels considered

significant enough to create a major impact when combined with other possible projects in the vicinity of the proposal.

To the extent that this pipeline consumes a limited ROW in the Snoqualmie Tunnel, some future utility may be precluded from building. A WorldCom fiberoptic line recently built in the Snoqualmie Tunnel also contributes to this limitation.

3.17.2.2 No Action

Under the No Action Alternative, the proposal would not be constructed. Petroleum products would continue to be transported between western and eastern Washington by tanker truck on interstate highways and by barges on the Columbia River. The number of trips per day by each means of transport would increase over time, requiring an increased consumption of energy (fossil fuels for barge and tanker truck operation and electricity for river lock operation) and increased risk of spills, requiring police and fire protection services. While this would be the primary effect on public services and utilities, the impact would be considered negligible.

3.17.3 Additional Proposed Mitigation Measures

No additional mitigation measures, beyond those included as part of the project by the applicant, are proposed.

3.18 HEALTH AND SAFETY

3.18.1 Affected Environment

The affected environment consists of resources that could be potentially impacted by an accident involving the proposal, and existing facilities and activities that could present a health or safety impact, with or without the project. Because a major issue is the potential for a petroleum spill or transport accident with or without the project, the affected environment includes major transport and handling routes and locations affected by the project and by No Action. In general, these include:

- pipeline alignment from Snohomish County to Pasco,
- truck terminal at Kittitas,
- barge activity areas near Harbor Island, Cherry Point, Marche Point, Puget Sound, and the Strait of Juan de Fuca,
- barge routes along the Pacific Coast and up the Columbia River to Portland,
- barge routes up the Columbia and Snake Rivers, and
- truck/barge terminals at Portland, Clarkston, and Umatilla.

The greatest geographical concentration of product per mile at a common location is along the pipeline. The greatest distance involved with transport of northwest refinery product to Pasco is via barge.

Resources that could be potentially impacted by an accident include vegetation, wetlands, wildlife, water (including Puget Sound, the Pacific Ocean, the Columbia and Snake Rivers, and dozens of smaller rivers), fisheries, people, and other resources. These are described in other sections of this EIS.

Existing facilities and activities that could present a health or safety impact include OPL's existing pipeline system, current petroleum product barging and terminal operations, and existing petroleum product trucking. This existing risk is summarized below, with the details presented in Appendix A. In addition, there are other pipeline systems, such as gas pipelines, that could be damaged during construction, thereby presenting a health or safety impact.

The design and operation of pipelines, barges, and trucks are closely regulated by federal and state agencies, as summarized below.

3.18.1.1 Applicable Regulations

Regulations are in place to reduce the potential for accidents involving pipelines, barges, and trucks. The transportation of hazardous liquids by pipeline is governed by 40 CFR Part 195, which prescribes safety standards and reporting requirements. The regulation prescribes minimum design requirements for pipelines and specifies the requirements for operation and maintenance.

The U.S. Coast Guard (USCG), through Title 33 (Navigation and Navigable Waters) and Title 46 (Shipping) of the Code of Federal Regulations, is the federal agency responsible for vessel inspection, marine terminal operations safety, coordination of federal responses to marine emergencies, enforcement of marine pollution statutes, and marine safety (e.g., navigational aids), and is the lead agency for marine spill response.

Subchapter C of CFR Title 49, Hazardous Materials Regulations, prescribes the requirements of the U.S. Department of Transportation (USDOT) governing the transportation of hazardous materials by, among other modes, interstate carriers by motor vehicle. The requirements also cover the manufacture, fabrication, marking, maintenance, reconditioning, repairing, or testing of containers, including cargo tanks, which are used in the transportation of hazardous materials, including petroleum products.

The Washington Utilities and Transportation Commission (WUTC) regulates public utilities in Washington such as telephone, electricity, natural gas, and refined petroleum. Part of this authority includes pipeline safety.

3.18.1.2 Existing Risk of Oil Spills, Fires, or Explosions

Existing petroleum transport facilities and activities, including pipelines, marine vessels, and trucks, have been involved in accidents in the past and have the potential to become involved again. Types of accidents include product releases, fires, and explosions and in the case of trucks, freeway and roadway accidents with the potential for collision, fires, injuries, and fatalities.

Product releases due to human error and at transfer points/fittings are the most common type of accident. This includes all points at which transfer moves from one mode of transport or storage to another. It also includes all physical transfer points such as pumps, valves, and hoses. In most cases, the released product flows with the terrain and collects in low spots. The released product can also begin producing flammable vapors after it is released. These vapors are blown with the wind and can ignite if they encounter an ignition source. If the vapors ignite, they normally burn back to the liquid and the vapors emanating from the pool begin to burn. An explosion is possible but unlikely.

The U.S. Coast Guard (DOT 1992) found that 80 percent of the volume of spills from vessels was from groundings, and that double hulls would prevent most grounding spills. In Washington from 1983 to 1996, major pipeline spills were smaller in volume than major vessel spills, but out of the 44 spills tracked, 86 percent were due to human or program error. In general, the less amount of human involvement in transport, the fewer number of spills.

Gasoline has a low flash point and is classified as a flammable material. The flash point of a liquid is the temperature at which sufficient vapors are produced at the surface of the liquid to be ignited by a flame. Gasolines are capable of producing a flammable vapor cloud at ambient temperatures. Diesel and jet fuel have flash points above 38°C (100°F) and are classified as combustible instead of flammable. They are not capable of producing a flammable vapor cloud under 38°C (100°F) unless heated to or above their flash points. If a combustible fuel were to be released under pressure as a spray, the resulting aerosol cloud may be flammable.

Estimates for the expected likelihood of accidents are presented in Appendix A and summarized below. The possibility of accidents from the existing OPL facilities remains the same, with or without the project, and constitutes a component of the existing environment.

Existing Olympic Pipeline. The existing 644 km (400-mile) OPL pipeline system in western Washington has had a total of 42 releases over its 32-year operating life (OPL 1998, Table 2.9-1), which is a spill rate exceeding one spill per year. Of these, 17 have been spills greater than or equal to 50 barrels (bbls) or 2,100 gallons in volume. Twelve of the releases have been along the pipeline and 29 at terminals, junctions, or stations. Statistics are included in Appendix A. The 400-mile distance involves main lines and all branch and delivery lines, pump stations, valves, and transfer points owned by OPL as part of the system from the northwest refineries to Portland.

Based on OPL's history and historical data on liquid pipeline failure rates, zero to two releases per year can be expected from the existing pipeline system, with zero to one of these releases possibly being over 50 bbls in volume. Based on historical experience, the chance is greater than 50 percent that these releases would occur at an OPL terminal, junction, or station, where the probability is high that the spill would be contained by the facility itself.

Existing Barging. A portion of the demand for refined petroleum products in eastern Washington is served by barge transportation of products. Barges on the Columbia River are loaded at the Tidewater Barge Lines, Inc. (Tidewater) terminal in Portland, Oregon, or at Vancouver, Washington, with products transshipped from oceangoing barges or tanker ships, or from the Olympic pipeline at OPL's Vancouver, Washington, terminal. Essentially all upriver petroleum transport is conducted by Tidewater. These barges move upriver and discharge their cargos at Chevron's terminal on the Snake River at Pasco, at the Tidewater terminals immediately upriver in Pasco, or at Tidewater terminals at Umatilla and near Clarkston. In 1995, approximately 43 percent of the demand for petroleum products in eastern Washington, or about 35,000 bbls per day, was met by barges traveling up the Columbia River (Energy Analysts International, Inc. 1995). In 1993, Tidewater carried an average of 33,000 bbls per day (Columbia River Towboat Association n.d.).

The current Tidewater fleet operating on the Columbia River consists of three large liquid bulk barges with approximately 65,000 bbls capacity each, and smaller 30,000 bbls capacity dual-use dry/liquid bulk barges. Currently, about 292 barge trips per year are made. The current trend is to discontinue the use of small dual-purpose barges for transport of product cargos, and to utilize the existing fleet of larger liquid bulk barges (OPL 1998, Appendix B-2, Product Spill Analysis). As barges are replaced, new barges will be double-hulled.

These barges receive product for upriver shipment via two major modes, the Olympic Pipeline and tanker shipment from the four northwest refineries through the Strait of Juan de Fuca.

Existing Trucking. Truck transportation has a higher historical number of releases per volume of product transported per mile than pipelines or marine vessels. Volume per release is much smaller. In addition, it has the highest fatality rate of the three transport modes because accidents may result in the truck driver's death or the death of an occupant in another vehicle or vehicles involved in the accident. The maximum amount of product that can be released from a truck accident is less because a release is limited to the amount of product that can be carried in a truck (generally, 8,000 gallons). For an accident in which gasoline is released, a fire may occur due to the flammable properties of gasoline and the possible sources of ignition (e.g., sparks, electrical sources, ignition of the vapor cloud from nearby vehicles, or other sources). There is a relatively low probability that spills of diesel or jet fuel would ignite, due to the higher flash point of these products.

Fatality Rates. The USDOT Research and Special Programs Administration's 1990 National Transportation Statistics - Annual Report provides information which puts the relative safety of trucks and pipelines, as well as other modes of transportation, in perspective.

The fatality rate for each mode was determined by dividing the number of fatalities by the number of ton-miles transported. The results are summarized in Table 3.18-1, with the risks normalized to produce a value of 1 for the lowest rate of the four categories so that the relative risks of the transportation modes may be more easily seen. Pipelines had the fewest number of fatalities per ton-mile transported. As shown in Table 3.18-1, highway transportation results in roughly 300 times more fatalities than pipelines for a given number of ton-miles transported. Order-of-magnitude comparisons between the other modes could be stated similarly.

Table 3.18-1. Normalized Fatality Rates for Transportation Modes

Mode	Rate
Pipelines (all fatalities)	1
Marine (excluding recreational boating fatalities)	3
Rail (all fatalities including those at grade crossings):	40
Highway (only truck fatalities)	300

Source: USDOT Research and Special Programs Administration's 1990 National Transportation Statistics - Annual Report.

Note: The fatality rate for each mode was determined by dividing the number of fatalities by the number of ton-miles transported. The risks are normalized to produce a value of 1 for pipelines, so that the relative risks of the transportation modes may be more easily seen.

Because truck accidents often, in addition, result in fatalities to persons in automobiles which are not included in the statistics, the trucking fatality figure shown in the table is low. That is, if the fatality figures for automobile passengers in truck-related accidents were included, the highway fatality rate listed in the table would be higher. Such statistics, however, are not readily available.

Product Releases. The expected number of petroleum product releases per year of any volume from the 65 tanker trucks per day presently transporting petroleum product to eastern Washington across Stevens and Snoqualmie Passes is 4.3. See Appendix A for details.

3.18.1.3 Potential Sizes of Releases to the Environment

Releases of petroleum product to the environment can impact many resources, including biological resources, water, land uses, and public safety. The previous section addressed the potential for accidents. This section addresses the potential size of releases.

Pipeline Systems. Leaks in pipeline systems can occur in gaskets, valves, tanks, and the pipeline itself. Most leaks are small (defined as less than 50 bbls [2,100 gallons] in volume, but frequently are much smaller such as would occur at a gasket or seal leak). However, pipeline ruptures can result in the release of a great deal of product (50 to 5,000 bbls or more).

The amount of product that can escape from a pipeline is comprised of the amount of product that can escape due to pumping prior to discovery of the leak and stopping of the pipeline pumps, plus the amount of product that can drain from the pipeline after the pumps are stopped. The amount of product that can be released from a pipeline is also a function of the diameter of the pipeline, the size of the hole in the pipeline, the pumping rate of the pipeline, the location of the leak relative to the elevation profile of the pipeline, the location of the pipeline valves, and the time it takes to detect the leak, shut down the pumps, and close appropriate valves.

The potential for small releases is greater than for a large release because small releases have historically occurred much more frequently. A study by the California State Fire Marshal (1993) regarding spill size distribution for releases from the approximately 12,553 km (7,800 miles) of hazardous-liquid pipelines in California resulted in the following conclusions:

- Twenty-seven percent of the incidents resulted in spill volumes of 1 bbl (42 gallons) or less.
- The median spill volume was 5 bbls (210 gallons).
- Sixty-one percent of the incidents resulted in spill volumes of 10 bbls (420 gallons) or less.
- Eighty-two percent of the incidents resulted in spill volumes of 100 bbls (4,200 gallons) or less (thus 18 percent of the spills were greater than 100 bbls [4,200 gallons]).

- Ninety percent of the incidents resulted in spill volumes of 650 bbls (27,300 gallons) or less.
- Ninety-five percent of the incidents resulted in spill volumes of 1,750 bbls (73,500 gallons) or less.
- The largest spill volume was 31,000 bbls (1,302,000 gallons).

Marine Vessels. Marine vessel transportation of petroleum products can result in releases during transfer and transit. Chambers Group, Inc. (1994) shows that the historical spill size distribution from terminals is approximately the same whether loading barges or tankers. Loading and unloading releases are normally small, while releases during transit are larger. The potential impacts from marine vessel spills are usually quite different than from pipeline or truck releases because the latter spills are not always in rivers or marine waters. The maximum size spill from a marine tanker or barge can equal the loaded capacity of the vessel, which can be 65,000 bbls (2.7 million gallons) for a barge or more for a tanker.

Trucks. The maximum size release from a tanker truck is the entire contents of the truck, which is approximately 190 bbls (8,000 gallons). Table 3.18-2 presents historical data on spill size distributions from truck releases which shows that most of the maximum load capacity is spilled 25 percent of the time when there is a release.

Table 3.18-2. Historical Spill Size Distributions from Truck Releases

Spill Size		
Barrels	**Gallons**	**Percent**
2.4	< 100	44
2.4 - 24	100 - 1,000	19
24 - 119	1,000 - 5,000	12
119 -190	5,000 - 8,000	25

Source: FEMA/USDOT/USEPA (undated).

A truck spill would normally occur on the roadway and flow with the contour of the road and surrounding terrain. It is also possible that such a release can enter an enclosed storm drain, drainage ditch, culvert, or the soil, or eventually enter a stream, lake, or wetland.

3.18.1.4 Safety

Pipeline, barge, and truck accidents can all present hazards to the public. Petroleum products, especially gasoline, can ignite and produce radiant heat that can burn people in or near the fire.

Gasoline vapors may also travel with the wind away from the actual release area and ignite. A truck carrying a petroleum product may become involved in an accident with another vehicle, causing death or injury to the truck driver and/or occupants of the other vehicle and property damage. (A May 1998 tanker truck accident in Pennsylvania resulted in the death of the driver and another vehicle driver, included a tour bus, and closed a major freeway for 2 months due to fire damage.) A spill from a marine vessel, although likely to produce water pollution and associated impacts, does not normally present a safety hazard because the spill is on water and away from members of the public. (A large barge spill near Rhode Island included 1,000,000 gallons of product on waters and beaches with no loss of human life or injury.) Spills at storage terminals are generally contained by required secondary containment facilities. Fires or explosions at terminals are rare and much less frequent than at refineries or processing facilities which involve pressurized vessels and higher temperatures. Combinations of these examples (i.e., a tanker truck accident and fatality at a product terminal near Portland in early 1998) can happen as well. All modes of transport present safety issues.

3.18.1.5 Solid, Hazardous, and Toxic Materials and Waste

Petroleum products are, in most cases, hazardous materials. If ingested, most petroleum products, including gasoline, fuels, oils, etc. are toxic. Ingestion, however, is not a reasonable result of construction or operation of a petroleum product pipeline system. Petroleum products are not designated as hazardous wastes, although used or waste oils sometimes are. The proposed pipeline would not transport used or waste petroleum products.

3.18.1.6 Emergency Response Plans

Emergency response plans (also called Spill Prevention, Control, and Countermeasure [SPCC] plans) are required and have been prepared for the existing OPL facilities. The outline for the existing plan is included as an appendix to the amended ASC (OPL 1998). These plans provide detailed actions to be taken in the event of potential accidents. The plans include specific notification lists and procedures, and the equipment, personnel, and contractors available for response actions. Response action management and responsibilities are designated, including capabilities and responsibilities of local emergency response facilities and personnel. The plans cover actions including shutdown of the system, pinpointing the location of a release as necessary, closure of valves, procedures and actions for containment and recovery of spilled materials, stream and river protective actions, cleanup, and other areas.

Emergency response plans are reviewed and updated periodically. The plans are intrinsic parts of personnel training and are required to be developed and in place before operation of a facility. Because they include description of names, phone numbers, equipment specifications, and locations, they are not available during the licensing process but are developed during design and construction. An SPCC plan will be required before operation of the proposed line under USDOT regulations.

3.18.1.7 Monitoring and Detection

The existing OPL pipeline system includes a Supervisory Control and Data Acquisition system, referred to as a SCADA system. In addition to providing for control and operation of the pipeline, the SCADA system provides leak detection capability by continuously monitoring (24 hours per day for 365 days per year) pipeline pressures, throughput, valve positions, pumping actions, and other variables. If the pipeline system parameters vary beyond normal values, the SCADA system provides warnings, alarms, or system shutdown as necessary.

The SCADA system can detect leaks or releases from the OPL pipeline system. The time required for detection varies inversely with the rate of release. That is, large leaks or ruptures are detected quickly, while small leaks require more detection time. A major failure or a leak greater than a few percent of flow can be detected immediately and the line shut down in minutes. A slow leak, near or below 1 percent of flow, may not be detected by SCADA and may not be detectable until it is visible at the leak location, via color, sheen, or vegetation effect.

The pipeline ROW is patrolled regularly by OPL personnel. This inspection is intended to detect activities on or near the ROW that could pose a threat to the pipeline, such as construction or excavation, as well as to detect discolored soil, dead vegetation, or other evidence of small leaks. This includes ground patrols and aerial fixed-wing aircraft inspections (at an average height of about 300 m or 1,000 feet above ground level) every 2 weeks.

The pipeline cathodic protection system is inspected periodically for proper operation. This system impresses a continuous electrical voltage on the metallic pipe itself, creating a barrier at the pipe surface, preventing electrolytic deterioration of the metal in water, wet soil, or other corrosive conditions over time. The current is supplied from anodes buried in the soil at intervals along the pipeline or at the other facilities. There are two types of cathodic protection: impressed current systems and galvanic systems. An impressed current anode is located in the soil either in a deep, well-ground bed or in a horizontal ground bed. The anode is interconnected to a direct current (DC) source, called a rectifier that is energized by conventional alternating current (AC) power sources.

3.18.2 Environmental Consequences

3.18.2.1 Proposed Petroleum Product Pipeline

Construction Impacts. Construction of the pipeline system pump stations and terminal has little or no potential for impacts on public health and safety, although construction accidents could affect construction workers. Potential traffic/transportation impacts are discussed in greater detail in Section 3.10, Traffic and Transportation. Impacts would be minimal because when trenching across roads, every effort would be made to maintain one lane of traffic through the use of flaggers and steel plates over open trench areas. If construction was not completed during work hours, all trenches across public roads would either be backfilled to grade or heavy steel plates would be placed across the trench and the location appropriately marked with warning signs prior to the completion of the day's work activities. Also, temporary closures would be planned to avoid peak travel times.

Construction workers could be at risk during construction in the Snoqualmie Tunnel (see Section 3.2, Geology, Soils, and Seismicity).

Construction activities could conceivably result in damage to other underground utilities. If such a utility were a flammable-gas pipeline or a flammable-liquid pipeline, any resulting fire could pose a hazard to nearby members of the public. However, because of the extensive efforts taken to locate and identify underground utilities in the vicinity of excavation work (a requirement of law), such damage to underground pipelines during construction would be extremely unlikely.

Impacts to traffic safety, and to the public, at road crossings or due to construction in or near road ROW can be mitigated by normal warning signing and lighting, and traffic control measures during construction. The potential impact would be negligible.

Operational Impacts - Overall Proposal. No health and safety impacts are expected to occur during operation unless an abnormal situation arises, such as an accident. Normal operation of a buried pipeline, pump stations, and terminal would not impact health or safety. However, because the probability of a spill over a projected 30-year project life approaches 100 percent, the project is likely to cause a pipeline spill over that period. (The project would also reduce the potential for other spills, as discussed for No Action later in this section). The preparation and implementation of emergency response plans for the system may result in impacts on community emergency response resources and personnel (see Section 3.17, Public Services and Utilities for impacts to fire fighting departments), merely by the required existence of the plans. These plans, developed in concert with the agencies and local emergency response personnel, can contain commitments to assist and enhance local capabilities.

Accidents associated with operation of the pipeline system can impact the health and safety of the public, as well as damaging other areas of the environment such as wetlands, fisheries, wildlife, and others. Spills of petroleum product at a pump station or at the Kittitas Terminal, although likely to be confined to the secondary containment areas, could ignite and pose the risk of radiant heat from the fire affecting members of the public who may be near the pump station or terminal. Fencing and security measures at each facility would limit public access.

The potential impacts resulting from a petroleum product release are a function of two measures: the probability of a release happening, and the possible volume of a spill. The actual risk of any facility can be expressed as frequency of occurrence times consequences of an event.

Probability of Pipeline Spill. The probability of a spill must take into account the characteristics of the proposed pipeline. The proposal is the construction of approximately 370 km (230 miles) of petroleum product pipeline, intended to initially transport 60,000 bbls per day (2,520,000 gallons per day) of gasoline, diesel, and jet fuel. The system would eventually expand to an ultimate capacity of 110,000 bbls per day (4,620,000 gallons per day) if demand supported such delivery.

The pipe would be 35.6 cm (14 inches) in outside diameter for approximately 200 km (124 miles) to Kittitas, and 30.5 cm (12 inches) in diameter for about 171 km (106 miles). The pipe wall thicknesses would be 0.71 cm (0.281 inch) for the 14-inch-diameter portion and 0.64 cm

(0.250 inch) for the 12-inch-diameter portion. Thicker pipe would be used at road, railroad, and stream crossings, and on bridges. The pipe material would be steel, with full-penetration, multiple-layer, X-ray checked, arc-welded connections. The pipe would be strengthened, coated, or protected with any of several materials as appropriate for the location (see project description in Chapter 2).

Several protective measures would be implemented, including cathodic protection of the steel pipe, burial in appropriate materials to a depth of a minimum 1.2 m (4 feet) below agricultural and other lands and deeper at other locations (including, at river crossings, burial to a minimum of 0.6 m [2 feet] below the scour depth), and clear marking of the ROW. Periodic tests and inspections of the pipeline would be carried out to meet or exceed legal requirements.

As described, the pipeline is state of the art, and its expected performance may be described through the use of statistics applicable to modern pipelines. Historically, leaks and ruptures in underground pipeline systems have been due to a number of causes (see Table 3.18-3). These causes are documented, for the most part, by the spill reports required by the USDOT Office of Pipeline Safety. Measures to reduce the causes of pipeline failure shown in Table 3.18-3 are as follows:

- **Third-party actions** have historically been the greatest causative factor in pipeline spills. Such activities include excavations during which the digging equipment hits and ruptures the pipeline or weakens slopes, post-hole drilling in which the pipe is pierced, and other such events. Marking and frequent surveillance of the ROW, as well as relatively recent legislation requiring notification of construction in the vicinity of pipelines and other underground utilities, are intended to reduce this cause of pipeline accidents.

- Cathodic protection electrical systems, pipeline wrapping and coating, use of corrosion inhibitors in the liquid being transported, and internal inspection of the pipe are intended to reduce the effects of **corrosion.**

- The use of computer-supported pipeline control and monitoring systems (see SCADA system description above) and operator training are intended to reduce the frequency of **operator error.**

- Construction techniques, particularly full-penetration arc welding and 100 percent X-ray inspection of welds, contribute to reduced incidence of **material and weld failures** in the pipe.

The age of a pipeline has been shown by historical experience to influence spill probability. A differentiation must be made between pipelines constructed in past years according to different (and usually less stringent) regulations, with poorer materials and methods, and with lesser protective measures, and the separate fact that pipelines experience an increasing probability of spill merely as a result of age, regardless of when they were built.

Table 3.18-3. U.S. Pipeline Failures by Cause

Cause of Spill	Percentage in U.S. 1980-1990	Percentage in U.S. 1994-1996
Third-Party Action, including Natural Causes	32	26
Corrosion (Internal and External)	27	23
Operator Error	7	7
Material Failure	4	5
Weld Failure	2	6
Other/Unknown [1]	29	33

Source: Office of Pipeline Safety, 1990, 1997.

(1) Since 1985, a separate recording of pipeline failures due to "malfunction of equipment" has been maintained by the USDOT Office of Pipeline Safety. This category appears to contain between 3 and 9 percent of all incidents. Prior to 1985, malfunction of equipment was included in the "other" category, and has been included here in the "other" category for consistency over the time period used.

There is a decided lack of usable data describing the increase in failure probability with age for modern pipelines (i.e., late 1980s and 1990s). Substantial data are available on the failure rate with increasing age for earlier pipelines. Considering the advances in construction methods, materials, inspection, control, and regulations, modern pipelines are expected to experience less increase in failure rate with age than older pipelines. Therefore, the use of age data for older pipelines is conservative (i.e., over-estimates the increase in failure rate of new pipelines with age).

The usual measure of pipeline spill probability is releases per mile per year. The expected rates of release for "leaks" (less than 50 bbls in volume) and "ruptures" (50 bbls or more in volume) for the proposed pipeline are shown in Table 3.18-4. These rates are based on historical pipeline failure rates, adjusted for new construction and the diameter of the proposed project pipe. Data, methods used for the calculations, and references are contained in Appendix A.

Table 3.18-5 shows the estimated number of failures for the proposed pipeline per year. These values were calculated by multiplying the length of each segment, in miles, by the failure rates in spills per mile per year from Table 3.18-4. The estimated spill rate for the new 370 km (230-mile) line when it is 30 years old is 0.1739 per year. This is less than one might expect, based on the 644 km (400-mile) existing line, which has 1.03 spills per year projected. This is due to risk factor improvements such as better welds, better pre-operation testing, better pipe materials, and construction techniques that reduce risks.

Table 3.18-4 Projected Pipeline Project Failure Rates

		Pipeline Age				
			0-5 years	5-15 years	15-25 years	25-30 years
Segment	Diameter (inches)	Failure Rate per Mile per Year				
Thrasher -Kittitas	14	Leaks		[illegible]	2.1×10^{-4}	4.9×10^{-4}
		Ruptures	3.75×10^{-5}	0.75×10^{-4}	0.9×10^{-4}	2.1×10^{-4}
Kittitas -Pasco	12	Leaks		[illegible]	2.5×10^{-4}	5.9×10^{-4}
		Ruptures	4.5×10^{-5}	0.9×10^{-4}	1.1×10^{-4}	2.5×10^{-4}

Note: A "leak" is a release of less than 50 barrels. A "rupture" is a release of 50 barrels or more.

Table 3.18-5. Estimated Spills per Year for the Proposed Project

		Pipeline Age				
			0 - 5 years	5 - 15 years	15 - 25 years	25 - 30 years
Segment	Length (Miles)	Spills per year				
Thrasher - Kittitas	120	Leaks	0.0105	0.0210	0.0252	0.0588
		Ruptures	0.0045	0.0090	0.0108	0.0252
Kittitas - Pasco	107	Leaks	0.0112	0.0225	0.0268	0.0631
		Ruptures	0.0048	0.0096	0.0118	0.0268
Total Expected Spills per Year (Leaks+Ruptures)			0.031	0.0621	0.0746	0.1739
Expected Recurrence Interval (Years)			32	16	13	6
Probability of one or more spills per year			3%	6%	7%	17%

Note: A "leak" is a release of less than 50 barrels. A "rupture" is a release of 50 barrels or more.

When first constructed, the proposed pipeline would have a total expected spill rate of 0.031 spills per year, or one spill over a 30-year life if the rate stayed constant (Table 3.18-5). This may be converted into a recurrence interval that is the statistically expected number of years between spills. When new, the proposed project is predicted to experience a spill every 32 years. With age, the recurrence interval between expected spills would fall from 32 years when the pipeline is new to 6 years after it has reached 25 to 30 years old. (If the new line spilled at the rate of the existing line, it would generate approximately one spill every 2 years.) Since the new pipeline would be constructed using the most recent construction techniques and materials, and would undergo

inspection and maintenance techniques that were not available decades ago, the predicted spill rate as the pipeline ages is expected to increase less (i.e., the spill projections may be conservative in the later years of the proposed project's life). Note that the existing 400-mile line, if it had a spill frequency of 4.9×10^{-4} (see Table 3.18-4), would be expected to have one spill every 5 years, which is a lower frequency than predicted (or observed) for the existing OPL line.

Volume of Pipeline Spill. The volume of a spill from a pipeline, should one occur, consists of three components or phases. The total volume of product spilled would be equal to the sum of the losses in Phases 1, 2, and 3 of a release:

- Phase 1: Spill from the moment of occurrence of the leak or rupture until the release is detected. This phase of the spill occurs with the product in the pipeline under operational pressure.

- Phase 2: Spill from the time that the release is detected until the pipeline system is shut down.

- Phase 3: Volume of product that drains from the point of release due to gravity, after the system and pumps have been shut down. This volume is influenced by the timing of valve closure, valve locations relative to the point of release, and the pipeline elevation profile as dictated by the intervening topography between the point of release and the nearest valves.

Phase 1 - Time to Detect a Spill. The proposal includes a leak detection capability as part of the SCADA system. The SCADA system would receive input data from pressure and temperature sensors along the pipeline, and compare the measured pressures to the profile of the calculated proper pressures in the line if the spill was of sufficient size to be detectable by the system. The characteristic of such a system is that the higher the rate of release during a spill, the more quickly the release is detected. A modern computer-supported leak detection system should be capable of detection, as a function of rate of release, as shown in Table 3.18-6.

Table 3.18-6. Time Required for Detection of Pipeline Leaks by a Modern Computer-Supported Leak Detection System

Rate of Releas (bbls/hr)	Time to Detect (hrs)
500	0.1 - 0.3
100	0.3 - 0.6
10	10 -14
1	24 - 30

The maximum amount of product that could be released prior to detection would occur at a release rate of 5 to 10 bbls (210 to 420 gallons) per hour for 10 to 14 hours. Over time, this 100 to 140 bbls (4,000 to 5,880 gallons) of product could be released in the hours before detection. Spills at lower rates than this, or below the detection level of the SCADA system selected, could continue for hours or days until detected at the spill location. Once detection occurs, additional spillage continues during shutdown.

Phase 2 - Time to Shut Down the Pipeline. Motor-operated valves (MOVs) or block valves such as those used for the proposed pipeline cannot be closed instantly, because the "hydraulic hammer" effect of suddenly stopping a long moving column of liquid could damage or rupture the pipe. MOVs could be closed in 5 minutes or less. For this phase of the spill, the time required to close the MOVs would result in the loss of approximately 385 bbls (16,170 gallons) at the ultimate capacity of the pipeline even if the pipeline were completely severed, or a loss of less than 10 bbls (420 gallons) in the event of a 100 bbl (4,200 gallon) per hour release.

Phase 3 - Drain-Down Spillage. Product loss from a leak or rupture in a pipeline can occur after shutdown as product runs out of the opening in the pipe due to gravity. Drain-down occurs because of changes in the elevation of the pipeline; product would run downhill in the pipe and out of an opening at a lower elevation. The topography in the vicinity of the leak is important because only product that is higher in elevation than the point of release would drain out. The line would not siphon until empty, it would drain until valves were closed or until that segment of the line was emptied from a higher elevation. Block valves, when closed, can prevent or reduce the volume of drain-down loss.

The project description (Chapter 2 of this EIS) lists the block valve locations on the proposed pipeline. The approximate volume per mile of a 12-inch and 14-inch line is 2,900 and 4,000 bbl, respectively. The volume that might actually spill at any location is determined largely by diameter and distance to the next high point between valves. The total volume between valves is not likely to be spilled because the elevation profile of the pipeline between any two block valves would allow only product that is higher than the point of opening to drain out. If the point of release were at the highest elevation between block valves, no drain-down loss would occur, and the total volume spilled would be limited to that lost in Phases 1 and 2 of the spill. If the point of opening in the pipe is not at the highest point between two block valves, much or all of the product in the pipe between the adjacent block valves and higher than the opening would drain out.

In any case, the maximum volume of product spilled in any scenario, during Phase 3 of a release, would be equal to or less than the volumes contained within segments between block valves. The greatest distance in steep topography in the Cascades is 13 miles, representing more than 50,000 bbl. Volumes are worst case for a detected spill because it is not likely that the entire volume could drain out.

Terminal Risks. The proposal includes the construction and operation of a terminal (the Kittitas Terminal), which would be located north of and adjacent to I-90 and east of Badger Pocket Road. This terminal would ultimately have nine tanks with an approximate storage capacity of 860,000 bbls (36,120,000 gallons) of product and a 420,000-gallon transmix/relief tank. It would

include truck loading racks and parking for tanker trucks. The entire terminal would be fenced to control unauthorized access.

The terminal would include secondary containments for the storage tanks as required by law. A spill from a storage tank would be confined to the secondary containment but poses the threat of fire, or generation of a flammable gas cloud which could be ignited if a source of ignition is encountered before the gas has dispersed to a concentration below its lower flammability limit. The area of the truck loading racks would be sloped and curbed to direct product which might be spilled during loading away from the trucks and loading hoses.

The remote location of the terminal, where the general public is unlikely to be present (and public access would be virtually impossible inside the fence), poses little to no risk to the health and safety of the public. The four employees at the facility would be exposed to the risk of spill and fire. Employees, however, are aware of the risks, and are trained to prevent or minimize occurrence of an accident and how to deal with one should it occur. The public may generally be described as unaware of the risk to which they may be exposed, unwilling to accept the risk if they knew of it, and unprepared to act or respond effectively should an accident occur (response capability is addressed in Section 3.17, Public Services and Utilities). In contrast, employees are specifically made aware of risks at a facility, accept the risk as part of the job, and are trained to react effectively and in a safe manner should an accident occur. Hazards to employees at the terminal would be no greater than risks at similar modern petroleum storage and distribution facilities elsewhere.

Construction of the proposal may result in closure of marine terminals at Umatilla and Clarkston (see No Action Alternative below). Closure of two waterfront petroleum product terminals would reduce the risk to the environment and possibly to members of the public who may be in the vicinity of those terminals should an accident occur. Qualitatively, the closure of two older waterfront terminals would be expected to reduce the overall level of risk to the environment and the public by more than the construction of the one newer inland Kittitas Terminal would increase this risk.

Trucking Risks. The proposal would essentially eliminate the petroleum product tanker truck transshipment activity crossing Snoqualmie and Stevens Passes. Local deliveries would continue a similar levels with or without the project. Based on mileage estimates and further discussion included with No Action (below), the proposal would result in near elimination of the annual projected number of northwest refinery transshipment petroleum product truck accidents, projected to be 4.3 spills and 1.7 fatalities per year at 65 trucks per day in 1997 under the No Action Alternative (Table 3.18-7). There would continue to be a residual risk with or without the proposed project due to service station deliveries along the I-90 and SR 2 routes. By 2026, risk of spills and fatalities would be reduced further if the proposal is implemented, because of an increase in truck traffic projected for the No Action Alternative. These benefits would be reduced somewhat by more truck traffic in some areas in eastern Washington (see No Action discussion below).

Table 3.18-7. Projected Spills and Fatalities Due to Trucking Under the No Action Alternative

Year	Expected No. of Spills per Year	Expected No. of Fatalities per Year
1997	4.3	1.7
2014	6.7	2.7
2026	8.5	3.4

Tidewater Barge Company has stated in a letter (Hickey pers. comm.) that if the proposal is constructed, Tidewater will discontinue barge shipments of petroleum products, and will close its Umatilla and Clarkston terminals. If barge operations supporting petroleum product transportation are halted at these two terminals, additional trucking of product might occur. At the Umatilla terminal, approximately 25 trucks per day would potentially divert an additional 39 km (25 miles) to Pasco. For some trucks, the Pasco locations may actually reduce miles. At the Clarkston terminal, about 9 trucks per day would potentially be diverted or rerouted to other points, but projections of any specific distances or alternative routes of travel would be speculative. In summary, if the barge operations are stopped and the two terminals are closed as a result of the construction of the proposal, the risk posed by trucking petroleum products as replacement of those terminal operations would slightly lessen the trucking risk reduction which is estimated to occur if the proposal is constructed.

Barging Risks. The proposal would reduce the risk of barge spills on the Columbia and Snake Rivers by eliminating existing product barge operations tied to upriver delivery (see No Action discussion below). It would also reduce the risk of barge spill near Harbor Island, Cherry Point, and Marche Point in Puget Sound, and reduce petroleum product barge activity in the Strait of Juan de Fuca and along the Washington Coast. Texaco, for example, ships product via barge in Puget Sound and along the coast at a rate of approximately five shipments per month; the other refineries ship product via barge as well.

Operational Impacts - Columbia River Approach and Crossing Options. The risk of spill from a pipeline is related most importantly to the length of the pipeline, given that appropriate modern construction techniques are used to address individual circumstances along the pipeline route, such as road and railway crossings, watercourse crossings, areas of geologic instability, and others. Alternative routes for the proposal across the YTC and Columbia River are addressed below.

The options for crossing the YTC involve small changes in the overall length of the pipeline. The statistical effect of these length changes is much smaller than the level of uncertainty and the overall accuracy of the spill projections described earlier. Therefore, a route chosen to cross the YTC would have no measurable effect on the spill risk frequency for the proposal.

The options for crossing the Columbia River include different crossing techniques, but little change in the overall length of the proposed pipeline. The small length variations result in no major change in the spill risk projections based on pipeline length alone. However, the use of an overwater crossing of any type exposes the pipeline to hazards not relevant with underwater crossings. These hazards include vehicle or train accidents, depending on the bridge used, and vandalism, including gunfire damage, any of which could result in a spill. An armored buried crossing successfully constructed under the Columbia River would have a much lower expected spill frequency risk than an aerial crossing.

Cumulative Impacts. Because petroleum spills themselves are infrequent, and unpredictable as to time and location, there is no anticipated cumulative impact as a result of spills, nor is it anticipated that petroleum spills would be cumulative with any other project impacts.

In addition, it is not anticipated that spills from tanker trucks on the roadway or barges in Puget Sound, along the Washington Coast, or on the Columbia River would create cumulative impacts as a result of No Action. Although increased trucking would create cumulative traffic and accident incidents, and increased barging would contribute to increased lock usage, neither is considered a significant adverse impact.

3.18.2.2 No Action

Construction Impacts. There are no construction impacts on health and safety associated with the No Action Alternative.

Operational Impacts. Under the No Action Alternative, the proposal would not be built. The demand for petroleum products from northwest refineries in eastern Washington would continue to increase and would be met by using other methods of transporting products to those areas. These transportation modes would include combinations of increased trucking by road and increased barge/tanker operations in the Columbia River, Puget Sound, and along the coast. The No Action Alternative has a 100 percent probability of a spill over time just as the proposal does. The frequency and location would be different for No Action. In addition, No Action may create a greater direct risk to human health and safety than the proposal due to tanker truck activity.

From a health and safety risk assessment viewpoint, the No Action Alternative is compared to the proposal by comparing the potential safety impacts of the proposed pipeline combined with a reduction in truck and barge spill risk to the potential safety impacts of the levels of trucking and/or marine operations necessary to move the product if the new pipeline is not built. Some of these risks have been quantified. Those for which data were not available are discussed on a more qualitative basis. OPL's existing pipeline would continue to operate at capacity in either case, and is not a factor in the health and safety differential which may exist between the proposal and the No Action Alternative. It is expected that the current trucking made necessary by capacity limitations of existing pipelines would be discontinued if the proposal is constructed, and therefore the trucking risks of the No Action Alternative must be evaluated on the total level of trucking projected, not just on the increase in trucking from the current level.

Trucking of Additional Product. Under the No Action Alternative, trucking of product would occur to meet the increased demands for petroleum products in Washington (see Chapter 2). The existing trucking of product is being done because of lack of transportation capacity in existing pipelines. According to OPL, the number of trucks necessary in the future would likely increase from the current 65 tanker trucks per day to an average of 101 trucks per day in 2014 and to 128 trucks per day in 2026. Construction of the proposal would eliminate the need for the current level of trucking, as well as preventing the need for increases in the future in the number of trucks to transport product. Each truck would carry about 190 bbls (7,980 gallons) of product and would travel from western Washington to eastern Washington from various points between Cherry Point and Harbor Island across Stevens or Snoqualmie Passes, a distance estimated (one-way) to average 443 km (275 miles). Risk of accident on return trips has not been included in this analysis.

Because the increase in trucking would be driven by the increase in demand if the proposal is not built, the health and safety impacts of the product trucking would increase over what would have been the 30-year life of the proposed project. Historical information is available to indicate the number of truck accidents, spills per accident (only about 19 percent of tanker truck accidents result in a release of cargo), and the truck-related fatalities per barrel-mile of petroleum product transported by highway. The potential number of spills and fatalities has been calculated for the total level of trucking that is projected to occur if the proposal is not constructed, based on the fact that the current trucking would not be continued if the proposed project is constructed. Two future points in time have been selected for calculation: 2014 and 2026. The projected figures are shown in Table 3.18-7. Spill and fatality projections for 1997 are also shown, based on the same calculational methodology as for the later years, but using the current (1996) trucking rates of 65 trucks per day. Spill and fatality projections for other years can be interpolated. Detailed calculations, data, and references are contained in Appendix A.

Table 3.18-7 indicates that spills and fatalities may be expected due to the increasing level of petroleum product trucking that is projected to occur if the proposal is not constructed. The volume of the trucking spills is limited to the volume that can be carried in one truck, approximately 190 bbls (7,980 gallons) (volumes of single tankers and double tankers are similar due to weight restrictions). Spills from a truck accident would flow with the contour of the ground surface and could flow into roadside ditches or storm drains, or could pool in low areas. It is considered highly likely that petroleum product spilled as a result of a truck accident would be ignited, due to sparks during the accident, the heat of the truck exhaust, or any of the other numerous sources of ignition present on and near roadways.

Barge Transportation of Additional Product. Under the No Action Alternative, barge transportation of product would continue to occur and would increase to meet the increased demands for petroleum products in eastern Washington (see Chapter 2). According to OPL, the barges on the Columbia River from northwest refineries would likely carry 22.5 million bbls (945 million gallons) per year in 2014, and 39 million bbls (1.64 billion gallons) per year in 2026. Each barge is estimated to carry up to 65,000 bbls (2.73 million gallons) of product for purposes of the calculation, although smaller volumes can be carried.

Historical information is available to indicate the number of barge leaks and ruptures per barrel of product transported. The potential number of barge leaks and ruptures has been calculated

for the total level of barge operations projected if the proposal is not constructed. Two points in time have been selected for calculation: 2014 and 2026 (in addition to the 1997 expected rates). Leak and rupture projections for other years can be interpolated. The projected figures are shown in Table 3.18-8. Detailed calculations, data, and references are contained in Appendix A. If smaller barges (less than 65,000 bbls) were used, the incidence of spills would increase because more trips and transfers would be required to transport the same volume of product.

Table 3.18-8. Projected Spills Due to Barge Operations Under the No Action Alternative

Year	Expected No. of Leaks per Year	Expected No. of Ruptures per Year
1997	0.131	0.025
2014	0.155	0.030
2026	0.175	0.034

Table 3.18-8 shows that leaks and ruptures may be expected due to the level of petroleum product barge transportation projected if the proposal is not constructed. The volume of barge spills would be limited to the volume that can be carried in one large barge, approximately 65,000 bbls (2,730,000 gallons). A barge leak, not involving rupture of the hull, would release much less than the maximum cargo. The category of leaks includes spills during loading and unloading of the barges. However, a rupture of the hull would not necessarily result in a full load spilled due to partitions within the hull.

Barge spill volume and frequency are uncertain due to two factors not incorporated quantitatively in the analysis. The first factor tends to reduce future spill risk without the project, while the second tends to increase spill risk without the project. First, Columbia River barges have begun to convert to double hull. This will reduce the spill risk from groundings both in frequency and volume. This would not have a significant risk reduction from collision or major accident and would offer no spill risk reduction from transfer operations. Overall spill risk by grounding without the project may be reduced with double hull barges. Single-hull barges are still operating. As the smaller single-hull barges convert to larger double-hull barges, the frequency of spills may decrease and the potential volume of spills may increase.

The second factor not included in the analysis is ocean and Puget Sound barge operations which occur during conditions of oversubscription. These activities are not incorporated into the overall quantitative rick assessment like the Columbia River barges are. No Action increases the risk of barge and tanker spill in Puget Sound and on the Pacific Coast of Washington. The number of barges moving on Puget Sound from the northwest refineries is currently greater than the number of barges hauled up the Columbia River.

Spills from a barge accident would float on the surface of the water, since all petroleum products at issue are lighter than water. It is possible that petroleum product spilled as a result of a barge accident would ignite, although this is not necessarily certain. A fire on the water's surface could endanger any persons in the vicinity, including those engaged in response to the spill. Estimates of injury or death to people as a result of such a fire would be speculative and without basis. Other than the potential for injury or death if a barge spill of petroleum product is ignited, injury or death of persons as a result of a barge spill is unlikely.

Water pollution and attendant impacts would occur in the event of a spill of petroleum product from a barge. Recovery of much of the petroleum product spilled is not likely. Gasoline would probably evaporate before collection efforts could be completed. Spilled diesel and other fuel oils could be recovered to some extent, if proper containment and recovery actions are taken in a timely manner.

Spill Risk of Proposal Relative to Existing Pipeline. The product spill risk of the existing pipeline can be estimated using the same statistical descriptors given above for the proposal, as adjusted for the length(s), diameter(s), and year of construction of the existing pipeline.

Using the values for a total length of 644 km (400 miles), 35.6 cm (14-inch) diameter, and 30 years of age, the existing pipeline currently poses a spill risk of 1.02 spills per year which is consistent with the known spill record. As shown in Table 3.18-5, when first constructed the proposed pipeline would have a spill risk of 0.031 spills per year. The proposal is projected to increase the spill risk posed by the entire OPL system by 3 percent without consideration for the spill risk reduction achieved by fewer trucks and barges. Details and calculations are contained in Appendix A.

3.18.3 Oil Spill Scenarios

An infinite number of pipeline spill "scenarios" could be postulated. The objective of selecting one or more hypothetical spill situations is to examine the environmental impacts of a spill at one or more selected locations and of some specific volume of spill at each location so that response plans may be prepared and/or potential impacts evaluated. The locations of the hypothetical spills selected for examination have considered the locations of resources especially sensitive to a petroleum product spill (e.g., wetland), locations where product would enter a waterway that would transport the spill into sensitive areas, or other considerations.

In its application for permits for the proposal, OPL carried out a product spill analysis (see Appendix B-2 of the ASC) that included a number of spill scenarios: 12 spill scenarios for the pipeline itself, two barge spills, two truck spills, and one tanker spill. The spill analysis assesses each of these hypothetical spill situations and draws a number of conclusions for each, including such information as magnitude or intensity of impact, extent and duration of impact, and the importance and sensitivity of receptors (the resources receiving the impacts).

Although the spill scenarios represent a small sample of the scope of possible product spills, the scenarios present a reasonable view of impacts that could result from petroleum product releases associated with the proposal and No Action Alternative. The only impact area not adequately covered in OPL's choice of scenarios is the possibility of injury or death to persons, including the public, as a result of a trucking accident and spill. These impacts are discussed earlier under "Trucking of Additional Product". A selected list of actual truck accidents is listed in Appendix A. The most recent one, a May 1998 gasoline tanker accident, killed two people.

The "Volume of Pipeline Spill" subsection discusses the potential volume of a product release from a break at any point along the proposed pipeline. The maximum volume that could drain out of a break in the pipe, after the block valves on each side of the break have been closed, is the entire volume of product in the pipe between the block valves. It is unlikely that this entire volume would, in fact, drain out, due to elevation changes in the pipeline.

In the analysis of the 12 pipeline spill scenarios, OPL conducted a detailed drain-down analysis, considering the topography of the pipe, pipeline hydraulics, and block valve spacing (some valve locations have been relocated since the analysis). OPL calculated the "practical worst-case discharge volumes" for each of the 12 spill scenarios. Across the 12 scenarios, calculations indicated that 2 to 81 percent of the volume of product contained in the pipe between a particular pair of block valves would drain out. The average amount calculated to drain out was 21.5 percent of the pipe contents (details are provided in Appendix A). While this is not a definitive calculation applicable to all possible release locations along the pipeline, it is a reasonable proportion of the pipe contents that could be expected to drain out in the event of a break in the pipeline.

Scenarios demonstrated that a significant amount of product could be released with or without the project. Well over 100,000 gallons (over 24,000 bbl) of product could be released by the proposed pipeline or by the No Action barge alternative. The analysis assumed an average of 20 percent of the volume of the line to the next block valve might spill under certain scenarios, exceeding 160,000 gallons. The same 20 percent applied to a full barge yields 546,000 gallons. Total product loss of a full barge would be 2.7 million gallons. This has not happened on the Columbia River and double-hulled barges will reduce the chance of this happening in the future. It has happened elsewhere, e.g., the barge North Cape which spilled more than 800,000 gallons along the Rhode Island Coast in January 1997. In this case a double hull would have made no difference (Waterhouse et al. 1998). However, this size and location of a spill was not selected as a scenario.

Impacts are discussed in the scenarios with consideration for location, size and characteristics of the spill. These discussions are also scenarios to provide the reader with an indication of possible events. Actual events are impossible to predict. Because there are so many spill possibilities involving barging, the pipeline, or trucking, if any major spill did occur it is more likely that the spill would not match one of these scenarios than that it would match one. Actual spill events listed in Appendix A demonstrate that fact. A spill exceeding 50,000 gallons immediately adjacent to Puget Sound last winter, for example, resulted in no release to waters, an occurrence which would not likely have been predicted in a scenario.

In conclusion, based on historical records and on product carrying capacity, both barge and pipeline are capable of spills exceeding 100,000 gallons.

3.18.3.1 Frequency vs. Volume and Spill Scenarios

The potential for a large volume spill exists with or without the project. A major pipeline rupture could release thousands of barrels of product, as shown in the spill analysis (ASC Appendix B-2 and in Appendix A of this document). Areas exposed to such pipeline spill potential would not be at risk if the proposal were not approved. A major barge accident could also release thousands of barrels into the Columbia or Snake Rivers or into Puget Sound or the Pacific Ocean. Areas exposed to barge spill risk would not be at reduced risk from northwest refinery product if the pipeline were approved. Areas along the pipeline corridor would be at reduced risk if the pipeline were not built, except for trucking activity close to some of the same resources. A 50,000 bbl spill, as an example, is possible from either scenario.

Accident and spill frequency is more likely from tanker trucks than from pipeline or barges. Spill volumes, however, are different. Maximum spill potential from a tanker truck would be 190 bbls (8,000 gallons). Such a spill could also affect the rivers and lakes along the I-90 corridor although not as directly as a pipeline crossing a river.

There are infinite spill scenarios involving size, location, season, and impact. This EIS does not attempt to describe them. As noted earlier, a number of spill scenarios are discussed in Appendix B-2 of the ASC. A major spill could occur with the project (from pipeline) or without the project (from barges). New areas and resources are at risk with the proposed pipeline. Truck spill accident risk and human health risk from traffic accident are greater without it.

3.18.4 Additional Proposed Mitigation Measures

3.18.4.1 Construction Mitigation and Subsequent Impacts

Damage to underground utilities during construction may be mitigated by liaison with the "Utilities Underground Location Center" for the State of Washington which is located in Bellevue, Washington. This non-profit organization is run by the utility companies in Washington and has responsibility for the proposal area. The phone number for the locating service is (800) 424-5555. Upon contact by OPL, this service would notify all owners or operators of underground utilities in the vicinity of construction, who would then support the construction crews in locating and avoiding underground utilities. With this mitigation, the potential impact on other utilities from accidental damage during construction would be negligible.

3.18.4.2 Operational Mitigation and Subsequent Impacts

- Exposure of the pipeline to vehicle or train accidents or vandalism for bridge crossings or the dam crossing of the Columbia River could occur, leading to a spill of product. Vandalism could be mitigated by applying extra protective coating, sheathing, or

covering of the exposed pipeline for all exposed crossings. The impacts, after mitigation, are evaluated as negligible.

- It is recommended that an additional block valve be placed at the west end of Lake Keechelus to reduce the potential spill volume from a leak or rupture along the lake and to remove all head pressure from a spill along the lake, which would reduce the potential spill rate.

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Chapter 4. Irreversible or Irretrievable Commitments of Resources

4.1 INTRODUCTION

This discussion identifies the irreversible commitment of natural resources over the long term which would be consumed or committed without potential for future recovery. The concept of irreversible or irretrievable applies to resources which remain unavailable long after the project is terminated and restored and long after it has ceased providing benefits.

Irreversible or irretrievable commitments of resources involves the commitment of resources which are not recyclable or making other resources unavailable for future use. This includes resources which are no longer retrievable, beyond the life of the project. For example, building a large shopping center over a coal or oil deposit may make these resources inaccessible. Cutting old-growth forest for various uses may commit this resource for hundreds of years before it is "retrievable" from regrowth. Use of any nonrenewable energy is a resource commitment.

The following sections discuss resources for which irreversible or irretrievable commitments might occur from the proposed project. Such commitments are not expected for threatened and endangered species, water, air quality, transportation, agriculture, recreation, or public services and utilities.

While construction of the pipeline would result in minor to moderate short-term impacts on habitats, an irreversible commitment of these resources is not anticipated. Protection of habitat during the construction and operation of this proposal would be conditioned by state and federal permits.

The cultural resource programmatic agreement would address mitigation so that no such irreversible commitment of cultural resources would occur.

4.2 PROJECT IMPACTS

Construction impacts could result in the loss of five populations of state sensitive and threatened plants as discussed in Section 3.4. This loss would be irretrievable unless the pipeline is routed to avoid these species.

Steel, concrete, and similar materials can be recycled at the end of the project's useful life if economically feasible and/or if this is made a condition of approval. That portion of the energy consumed by the pump stations which is not renewable (hydro, solar) would be irretrievable. Overall energy consumption of non-renewable energy would be less for the proposal than for No Action.

4.3 NO ACTION

Accidents affecting the health or loss of life of people, whether from the project or from No Action, would be an irretrievable loss.

Chapter 5. Consultation and Coordination

5.1 SCOPING

The U.S. Forest Service (USFS) published a Notice of Intent in the Federal Register to announce the proposal and the USFS intent to prepare a NEPA EIS on February 22, 1996. Comments were solicited and received from local, state, and federal agencies and the public.

A series of public scoping meetings was held at five locations on five different days in late March 1996. Meetings were held in Snohomish County, North Bend, Royal City, Othello, and Pasco. An agency scoping meeting was held April 3, 1996, at the USFS North Bend office.

Comment letters were accepted by EFSEC and the USFS until April 15, 1996. A newsletter was subsequently issued by EFSEC which summarized the key issues raised during scoping. A second newsletter was issued in late 1997 to update recipients on the status of the project and a potential schedule for the EIS, the permitting process, and future opportunities for public comment.

In response to requests to provide further input to the process, including issues associated with oil spills, ROW impacts, and alternatives, EFSEC sponsored an additional public meeting at the Seattle Army Corps of Engineers (ACOE) meeting room in summer 1997.

Comments and letters have been received by EFSEC, USFS, and Jones & Stokes Associates (consultant to the lead agencies) regarding spill risk, Purpose and Need, alternatives, and other issues throughout the Draft EIS preparation period.

5.2 CONSULTATION

The section titled "Agency Roles and Decisions to be Made" in Chapter 1 details permit, approval, and consultation requirements for the proposed pipeline project. Some of the necessary consultation has already begun as described below.

Consultation with the U.S. Fish and Wildlife Service (USFWS) occurred to identify any potential plant species listed, or potentially listed, as threatened, endangered, or candidate under the Endangered Species Act. No known federally listed threatened or endangered plant species occurs on the proposed route, and no permits are expected to be required from USFWS for botanical resources.

OPL initiated consultation with both federally and non-federally recognized tribal organizations and the State Historic Preservation Office (SHPO) to discuss traditional cultural

properties and other concerns (Table 3.11-1). The purpose of the consultation is to request information and provide opportunities for the tribes to state their concerns about cultural resources and environmental topics. In addition to interest in historical and traditional cultural properties, tribes may have concerns about burials, certain minerals, and native plants and animals and their habitats. Most of the tribes listed in Table 3.11-1 had aboriginal territories that included the proposed pipeline corridor. Two of the groups, the Warm Springs and Nez Perce, were included in the consultation because of treaty rights for fishing in the Columbia River system. A number of tribal organizations have responded to letters regarding the project proposal, and consultation continues.

For effects on recreationists, OPL is in the process of developing temporary signage and notices in consultation with King County for the sections of the pipeline route that use the Cedar Falls Trail. The notices would be posted about 30 days before construction would start along the trail, and would inform trail users of the approximate dates of construction, areas of temporary trail closures, and detour routes if available. A similar system could be developed for the Iron Horse State Park/John Wayne Pioneer Trail.

The ASC map atlas prepared in February 1996 presented a proposed centerline based on known issues at that time. Since then, a number of route changes within the proposed corridor were made by OPL based upon findings from additional field studies and after consultations with federal, state, and local agencies and property owners. Micrositing refers to specific alignment changes made along the proposed centerline. Micrositing of the pipeline will continue to occur to avoid problems or minimize impacts, with further consultation with landowners and agencies.

The USFS, as the lead federal agency, is required under Section 7 of the Endangered Species Act to enter informal consultation with the USFWS by preparing a biological assessment. The assessment must determine if the project would affect any listed species or critical habitat units. A USFS finding of "not likely to adversely affect" listed species and/or designated habitat must be confirmed through written USFWS concurrence. Should the biological assessment document that the project may affect a listed species and/or critical habitat unit, then the USFS should enter formal consultation with the USFWS. Under formal consultation, the USFWS would prepare a biological opinion to determine if the project would jeopardize the continued existence of a listed species. This consultation has not yet occurred but will occur before the EIS process is complete.

References

For brevity, the EIS text uses acronyms to refer to some authors of documents listed below. These acronyms, and the full names of the authors they stand for, are as follows:

ACOE. See *U.S. Army Corps of Engineers.*

BLM. See *Bureau of Land Management.*

Ecology. See *Washington Department of Ecology.*

EPA. See *U.S. Environmental Protection Agency.*

MBSNF. See *Mt. Baker-Snoqualmie National Forest.*

OPL. See *Olympic Pipe Line Company.*

SCS. See *U.S. Soil Conservation Service.*

USFS. See *U.S. Forest Service.*

USFWS. See *U.S. Fish and Wildlife Service.*

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List of Acronyms and Abbreviations

AC	alternating current
ACOE	Army Corps of Engineers
ADT	average daily traffic
ALS	Advanced Life Support
AMA	Adaptive Management Area
ASC	Application for Site Certification
ASILs	Acceptable Source Impact Levels
bbls	barrels
bblsper day	barrels per day
bbls per hour	barrels per hour
BLM	Bureau of Land Management
BLS	Basic Life Support
BMPs	Best Management Practices
BNRR	Burlington Northern Railroad
BOR	Bureau of Reclamation
BPA	Bonneville Power Administration
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
cg	centigram
CHUs	Critical Habitat Units
cm	centimeter
CO	carbon monoxide
CSZ	Cascadia Subduction Zone
dBA	A-weighted decibels
DC	direct current
DOD	Department of Defense
Ecology	Washington State Department of Ecology
EDNA	environmental designation for noise abatement
EFSEC	Energy Facility Site Evaluation Council
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	evolutionary significant unit
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FR	Federal Register
GIS	Geographic Information System
GMA	Growth Management Act
gpm	gallons per minute
ha	hectare
HC	hydrocarbons
HDD	horizontal directional drilling
I-5	Interstate 5
I-90	Interstate 90
ICBEMP	Interior Columbia Basin Ecosystem Management Project
ILS	intermediate life support
IMPLAN	Impact Planning (economic impact model)
kg	kilogram
kg/m^3	kilograms per cubic meter
km	kilometer
km^2	square kilometer
kV	kilovolt
kWh	kilowatt-hours
Leq	equivalent constant sound level
LOS	level of service
LSR	Late-Successional Reserve
LWD	large woody debris
m	meter
M	magnitude
m^2	square meter
m^3	cubic meter
m^3/s	cubic meters per second
MACT	Maximum Achievable Control Technology
MBSLRMP	Mt. Baker-Snoqualmie National Forest Land and Resource Management Plan
MBSNF	Mt. Baker-Snoqualmie National Forest
mg/l	milligrams per liter

MIS	management indicator species
MLA	Mineral Leasing Act
MOVs	motor-operated valves
MP	mile post
mph	miles per hour
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NFP	Northwest Forest Plan
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
OAHP	Office of Archaeology and Historic Preservation
OFM	Office of Financial Management
OPL	Olympic Pipe Line Company
OSHA	Occupational Safety and Health Administration
PA	programmatic agreement
PHS	Priority Habitats and Species
PL	Public Law
PM10	particulate matter less than or equal to 10 microns in diameter
PSAPCA	Puget Sound Air Pollution Control Authority
PSD	Prevention of Significant Deterioration
psi	pounds per square inch
RCRA	Resource Conservation and Recovery Act
RCW	Revised Code of Washington
ROD	Record of Decision
ROS	Recreation Opportunity Spectrum
ROW	right-of-way
RVs	recreational vehicles
S&Gs	Standards and Guidelines
SCADA	Supervisory Control and Data Acquisition
SCS	Soil Conservation Service
SEPA	State Environmental Policy Act
SHPO	State Historic Preservation Office
SIPs	State Implementation Plans
SMP	Shoreline Master Program
SO_2	sulfur dioxide
SPCC	Spill Prevention, Control, and Countermeasure
SQER	Small Quantity Emission Rate
SR	State Route
SWMM	Stormwater Management Manual for the Puget Sound Basin
TSP	total suspended particulates
TSS	total suspended solids
UGA	Urban Growth Area
USC	U.S. Code
USCG	U.S. Coast Guard
USDOT	U.S. Department of Transportation
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VMS	Visual Management System
VOCs	volatile organic compounds
VQOs	Visual Quality Objectives
WAC	Washington Administrative Code
WARIS	Washington Rivers Information System
WDFW	Washington Department of Fish and Wildlife
WDNR	Washington Department of Natural Resources
WNF	Wenatchee National Forest
WNHP	Washington Natural Heritage Program
WRIA	Water Resource Inventory Area
WSDOT	Washington State Department of Transportation
WUTC	Washington Utilities and Transportation Commission
YTC	Yakima Training Center

Glossary

Aggradation - The geologic process by which the level of a streambed is raised by deposition of sediment eroded and transported from other areas.

Agriculture (land use category) - Includes irrigated cropland and dryland farming (grains).

Air Pollutant - Dust, fumes, mist, smoke, other particulate matter, vapor, gas, odorous substance, or any combination of these.

Alluvial - Composed of alluvium or deposited by a stream or running water.

Alluvial Fan - A cone-shaped deposit of alluvium made by a stream where it runs out onto a level plain, usually at a mountain front, or meets a slower stream.

Alluvium - A general term for all deposits resulting from the operations of modern rivers and creeks, including the sediments laid down in riverbeds, floodplains, and fans at the foot of mountain slopes.

Ambient Air Quality Standard - An established concentration, exposure time, and frequency of occurrence of air contaminant(s) in the ambient air which shall not be exceeded.

Ambient Level - The existing level of air pollutants, noise, or other environmental factors used to describe background conditions (i.e., conditions before a project is implemented).

Anadromous - Migrating from salt water to spawn in fresh water, as do salmon.

Andesite - A dark extrusive volcanic rock very similar in appearance to basalt, but different in chemical composition. It is commonly found in the Cascade Mountains.

Aquifer - A body of rock or sediments that contains sufficient saturated permeable material to yield economical quantities of water to wells and springs.

Argillite - A fine-grained rock whose degree of induration (hardness) is somewhat higher than mudstone or claystone, but softer than shale.

Background - The distance at which visual elements lose detailed distinctions, where the emphasis is on the outline of a form.

Basalt - A dark extrusive volcanic rock very similar in appearance to andesite, but different in chemical composition. It is primarily found in the Columbia Basin.

Bankfull Width - The mean water width that occurs during a bankfull streamflow event, when streamflow completely fills the stream channel up to the top of the bank.

Bathymetric - Relating to measurement of depth below water.

Bedload Transport - Movement of sediment on or near the streambed due to currents.

BMPs - "a practice or combination of practices that are determined to be the most effective and practicable (including technological, economic, and institutional considerations) means of controlling point and nonpoint pollutants at levels compatible with environmental quality goals" (Soil Conservation Society of America 1982 in EPA 1993).

Breccia - A volcanic rock made of angular coarse fragments in a matrix of basalt, andesite or tuff.

Cairn - A pile of stones set up as a monument or landmark.

Clearance Survey - A survey conducted by a qualified wildlife biologist to determine the presence or absence of specific species and/or their nest sites. Clearance surveys are conducted prior to conducting land disturbing activities. Information gained from clearance surveys is generally valid for the year that they are conducted, since wildlife use patterns often change from year to year.

Colluvium - Loose deposits at the foot of a slope or cliff, brought there principally by gravity.

Confined Aquifer - An aquifer where groundwater is generally subject to pressure greater than atmospheric.

Conglomerate - A coarse sedimentary rock consisting of rounded fragments cemented together by another mineral substance.

Critical Habitat Unit - The specific areas designated by the USFWS as essential to the conservation of a threatened or endangered species and/or which may require special management considerations or protection (Endangered Species Act, Section 3[5][A]).

Cryptogamic Crust - A layer of intermixed mosses, lichens, algae, and microfungi that grow on the ground surface between grasses and shrubs. Cryptogamic crusts in Washington are found on shrub-steppe communities in eastern Washington and prairies in the Puget Trough Lowlands of western Washington. Cryptogamic crusts can provide for soil surface stabilization and reduction of soil erosion, improvement of soil fertility, retention of soil moisture, and may help to minimize the establishment of non-native herbaceous plants.

Decibel (dB) - A unit of measure for sound.

dBA - Stands for "A-weighted decibels". This decibel scale is used to approximate the way human hearing responds more to some sound frequencies than to others.

Debris Flow - A general designation for a rapid flowage involving earth, rock and vegetation.

Debris Avalanche - A sudden movement downslope of the soil mantle and overlying vegetation on steep slopes.

Designated Critical Habitat - See Critical Habitat Unit.

Dissolved Oxygen - The concentration of free molecular oxygen in the water column, often measured because it is important for fish and other aquatic life.

Dormant (landslide) - A landslide that is not presently active; that is, no fresh signs of movement. However, it could reactivate in the future.

Downcutting - The lowering of a stream channel due to scouring by streamflow.

Emergent Wetland - Any area of a vegetated wetland where non-woody vegetation (e.g., cattail, grasses, sedges) comprises at least 30 percent areal cover.

Emission - The release of air contaminants into the ambient air.

Emission Standard - A requirement established under the federal Clean Air Act which limits the quantity, rate, or concentration of emissions of air contaminants on a continuous basis.

Flood Basalt - A term applied to basaltic lavas that occur as vast composite accumulations of horizontal or subhorizontal flows over great sectors of the earth's surface on a regional scale.

Fluvial - An adjective pertaining to rivers or river action; synonymous with alluvial.

Forb - Non-woody plants that commonly have green stems and leaves and produce flowers. Forbs do not include grasses and grasslike plants.

Foreground - The area of the view in which the viewer is a direct participant, and where features can be distinguished with clarity not possible in the middleground and background. See Middleground and Background.

Forest (land use category) - Includes public or private forest lands and tree farms, and may be designated for recreational uses.

Forested Wetland - Any area of vegetated wetland where woody vegetation over 20 feet tall and dominated by trees (e.g., alder, cedar, hemlock, cottonwood, some willow species) comprises at least 30 percent areal cover.

Fugitive Dust - A particulate emission made airborne by forces of wind, human activity, or both. Unpaved roads, construction sites, and tilled land are examples of areas that originate fugitive dust.

g - A unit of acceleration equal to the acceleration of gravity, approximately 32 feet per second per second.

Glacial Till - A non-sorted, non-stratified, compact sediment carried or deposited by a glacier, consisting of silt, sand and gravel with scattered cobbles and boulders, and locally slightly clayey.

Glacial Outwash - Glacial sediments, commonly sand and/or gravel, deposited by meltwater streams issuing from a glacier.

Granite - A light colored, hard intrusive igneous rock made essentially of quartz and feldspar.

Graywacke - A hard dark sandstone with large quartz and feldspar particles set in a clayey matrix.

Headscarp - The upper boundary of a landslide that is normally defined by a vertical and/or horizontal rupture in the ground surface or a sharp break in topography. In an old landslide, such a feature may not still be open or retain its angularity.

Herbaceous - Annual or perennial plants that do not produce woody stems or branches. Herbaceous plants include grasses and forbs.

Holocene - The more recent of the two epochs of the Quaternary period, from the end of the Pleistocene to the present. See Pleistocene.

Horizontal Directional Drill (HDD) - A method for installation of pipes beneath rivers, lakes, wetlands and landslides in which a drill is remotely directed, generally in an arcuate line, below the obstruction and a pipe is then pulled back through the hole created by the drill.

Hydrofracturing - The process of opening cracks and bedding planes by pumping of water or other fluid at high pressure, resulting in increased permeability in the geologic formation.

Hydrostatic Test - A test of the strength and leak resistance of a vessel or pipe by internal pressurization with a test liquid, such as water.

Intermittent Stream - A stream that flows in a well-defined channel in response to precipitation and is dry for part of the year.

Lacustrine - An adjective pertaining to sediments produced by or formed in a lake.

Lake Missoula Floods - Immense outpourings of water unleashed on central and eastern Washington between about 12,000 and 15,000 years ago when glacial ice dams burst, releasing the waters of impounded glacial Lake Missoula.

Large Woody Debris (LWD) - Logs, stumps, rootwads, and branches that are on, in, or near a stream channel.

Late-Successional Forest (old-growth) - A forest in its mature and/or old-growth stages. Typical characteristics are moderate to high canopy closure, a multilayered and mutispecies canopy dominated by large overstory trees, numerous large snags, and abundant coarse woody debris (such as fallen trees) on the ground. Typically, stands 80 to 120 years old are entering this stage

(definition from the Snoqualmie Pass Adaptive Management Area Plan FEIS, USFS/USFWS 1997).

Leq - Stands for "equivalent constant decibel level". In noise analysis, Leq is used to develop averages of varying noise levels over a given period.

Level of Service (LOS) - A measure of operational conditions within a traffic stream and their perception by motorists and passengers. Factors such as vehicle speeds, traffic flow, and the comfort of drivers are considered in determining LOS. Six levels of service are defined, ranging from LOS A (best operating conditions) to LOS F (worst conditions).

Lithic - Of or pertaining to stone.

Loess - A homogeneous, non-stratified wind-blown deposit consisting predominantly of silt and fine sand.

Major Source - Any stationary source which emits or has the potential to emit 100 tons per year of any air contaminant regulated by the state or federal Clean Air Acts.

Mass Wasting - A general term for a variety of processes by which large masses of earth material are moved by gravity either slowly or quickly from one place to another.

Metagabbro - A dark hard intrusive igneous rock that has been altered by heat and/or pressure below the earth's surface.

Micron - A unit of measurement equal to a millionth of a meter, or about 0.00004 inch.

Middleground - The area of the view where visual elements begin to join, and where visual detail becomes lessened as compared to the foreground view. See Foreground.

Nonattainment Area - A geographic area which has been designated by EPA as exceeding a national ambient air quality standard or standards for one or more of the criteria pollutants.

Nitric Oxide - A gas that reacts with oxygen to form nitrogen dioxide.

Nitrogen Dioxide (NO_2) - A reddish-brown gas that is a component of smog.

Nitrogen Oxides (NO_x) - A group of compounds containing varying proportions of nitrogen and oxygen; one of these, nitrogen dioxide, is a primary component of smog.

Noise Attenuation - A reduction in noise caused by distance, absorption of noise by vegetation or buildings, or other factors.

Old-Growth. See Late-Successional Forest.

Ozone Precursors - Chemicals that react in the atmosphere, in the presence of sunlight, to form ozone; automobile exhaust is a common source of ozone precursors.

Particulate Pollutants - Air pollutants consisting of suspended particles; health concerns focus on those particles small enough to reach the lungs when inhaled.

Perennial Stream - A stream that flows most of the year in a well-defined channel.

Pollutant Emissions - The amount (usually stated as a weight) of one or more specific compounds introduced into the atmosphere by a pollution source or group of sources.

Pieziometric Surface - An imaginary surface representing the total head of groundwater in a confined aquifer that is defined by the level to which water will rise in a well.

Pleistocene - The earlier of two epochs comprising the Quaternary Period, spanning the time period from about 2 million to 10,000 years before the present.

Primary Pollutant - A pollutant that is emitted directly from an emission source into the atmosphere. See Secondary Pollutant.

Priority Habitats and Species (PHS) - A non-regulatory designation by the WDFW of species and habitat types that are priorities for management and preservation. The WDFW maps PHS information, including known locations of nest sites, wintering areas, and other important habitats and species locations. However, PHS maps are not considered a complete inventory of habitats and species.

Quaternary - The geologic time period extending from about 2 million years ago to the present. It is subdivided into the Pleistocene and Holocene epochs.

Rangeland (land use category) - Includes land which is used for, or is suitable for grazing of livestock; also includes arid lands which are marginally suited or unsuited for either crops or grazing.

Reactive Organic Gases (ROGs) - The components of organic gases that react with nitrogen oxides to form ozone.

Receptors - Sites or facilities that could be affected from additional noise, pollution, or other changes generated by a project.

Recreation (land use category) - Includes both public and private recreation areas and facilities, and may be forested or within an area used for forest harvest.

Rhyolite - A light-colored, fine-grained to glassy extrusive volcanic rock.

Riparian Area - The area adjacent to streams, rivers, lakes, and ponds which provides important fish and wildlife habitat and water quality.

Rural Residential (land use category) - Land which has been developed for residential use on larger parcels, typically in excess of two acres and often much larger. Land may be used for agriculture or left in forested conditions, but the primary use of the land would not be considered commercial agriculture or forestry. Small commercial or light-manufacturing may be present.

Sandstone - A cemented or otherwise compacted sedimentary rock comprised predominantly of quartz grains the size of sand.

Scouring - Erosion of streambed by the action of flowing water.

Scrub-Shrub - A plant community dominated by shrubs that are commonly less than 20 feet tall. Scrub-shrub communities in eastern and western Washington include species such as willow, alder, salmonberry, and spiraea.

Scrub-Shrub Wetland - Any area of a vegetated wetland where woody vegetation less than 20 feet tall (e.g., willows, spiraea, salmonberry) comprises at least 30 percent of the areal cover.

Secondary Pollutant - A pollutant, such as ozone, formed through chemical reactions in the atmosphere. A secondary pollutant differs from a primary pollutant, such as carbon monoxide, which is emitted directly into the atmosphere.

Sensitive Species - Those species of plants or animals that are not listed under the Endangered Species Act but have been identified by either the USFS, USFWS, or WDFW as species of concern requiring special management emphasis to prevent them from becoming threatened or endangered in the future.

Shale - A laminated sedimentary rock in which the constituent particles are predominantly of clay.

Shrub-Steppe - A vegetation type found in the northern part of the Great Basin area of the United States where low precipitation and cold winters occur. Shrub-steppe communities are dominated by short perennial bunchgrasses, cold desert shrubs, and in undisturbed regions a cryptogamic crust.

Siltstone - A fine-grained consolidated sedimentary rock comprised predominantly of silt.

Slump - A form of landslide in which the mass moves down and out as a generally coherent unit.

Sulfur Dioxide (SO_2) - A compound that reacts with sunlight and other pollutants, contributing to atmospheric haze.

Tectonics - Pertaining to features related to the deformation of the earth's crust.

Tertiary - The older of the two geologic periods comprising the Cenozoic Era, spanning the time period from about 65 million to 2 million years before present.

Toxic Air Pollutant - Any Class A or B toxic air pollutant listed in WAC 173-460-150 and 173-460-160.

Tuff - A rock formed of compacted volcanic fragments, generally smaller than 4 mm in diameter.

Unconfined Aquifer - An aquifer where the water table is exposed to the atmosphere.

Underfit Channel - A stream that appears too small to have eroded the valley in which it flows.

Urban (land use category) - Land which has been developed at varying densities, typically with suburban subdivision characteristics and some commercial or industrial uses

Volatile Organic Compound (VOC) - Any of several compounds of carbon which participate in atmospheric photochemical reactions, forming secondary pollutants. See Secondary Pollutant.

Water Table - The surface of a body of unconfined groundwater at which the pressure is equal to that of the atmosphere.

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APPENDIX A

Spill Risk Information:

- Calculations for Section 3.18 of EIS
- Summary of Pipeline Spill Scenarios
- Historical U.S. Oil Spill Incidents in the 1980 - 1998 Time Frame
- Table A-1. Petroleum Release History for Olympic Pipeline, 1966 - 1997

CALCULATIONS FOR SECTION 3.18 OF EIS

Calculation of leak and rupture probability for the Proposed Project

1. Probability of leak and rupture:

Leak (less than 50 bbl volume): 0.7×10^{-3} /mile/year
Rupture (50 bbls or greater): 0.3×10^{-3} /mile/year

Source: Mastrandea, 1982. Not dependent on volume transported. Represents U.S. pipeline industry failure rates for 1980. Based on 10" pipe operating at 1000 psi.

Other data sources:
a) Pacific Pipeline, 1996. Leaks - 0.54×10^{-3}; Ruptures - 0.27×10^{-3}. Based on new pipe, 20" diameter.
b) Existing Olympic Pipeline. Leaks - 1.8×10^{-3}; Ruptures - 1.3×10^{-3}. Based on actual performance, pipeline construction in 1965, diameters from 12" to 20."

2. Correction for pipe diameter:

14" pipe - 0.5; 12" pipe - 0.6 (Source: ibid)

3. Correction for age of pipe:

0-5 yrs - 0.25; 5-15 yrs - 0.5; 15-25 yrs - 0.6; 25-30 yrs - 1.4
(These factors are based on spills >50 bbls, and have been used for all spill size age corrections.)
(Source: Ibid)

4. Calculation of spill rate projection:

Example: Leak, pipeline 0-5 yrs old, 12" dia. segment:

0.7×10^{-3} leaks/mile/year x 0.6 correction for 12" pipe x 0.25 correction for age
= 1.05×10^{-4} leaks per mile per year.
This value is entered in Table 3.18-4; other values in the table are calculated in a similar manner.

5. Calculation of projected number of spills:

Example: Leak rate for Kittitas to Pasco segment, length 107 miles, within first 5 years.

1.05×10^{-4} leaks per mile per year x 107 mile length
= 0.0112 leaks per year (projected during the first 5 years of the pipeline life).
This value is entered in Table 3.18-5; other values in the table are calculated in a similar manner.

Calculation of Truck Spill Rate, No Action Alternative

1. Spills per truck-mile

3.51×10^{-6} accidents/truck mile x 0.188 releases/accident
= 6.6×10^{-7} spills/truck mile

Source: US DOT, Federal Highway Administration, 1990.
Present Practices of Highway Transportation of Hazardous Materials.
Hazardous materials include crude oil and petroleum products.

2. Calculation of truck transportation without proposed project:

In 2014, an increase to an average of 101 trucks/day is projected, and in 2026, an increase to an average of 128 trucks/day (No Action Alternative description).

In 2014: 101 trucks/day x 365 days/year x 275 miles/trip
= 10.14×10^{6} miles/year (note: only loaded direction counted)

In 2026: 128 x 365 x 275 = 12.85×10^{6} miles/year.

3. Calculation of projected spills/year for No Action Alternative:

2014: 10.14×10^{6} miles/year x 6.6×10^{-7} spills/mile
= 6.7 spills/year
2026: $12.85 \times 10^{6} \times 6.6 \times 10^{-7}$ = 8.5 spills/year

These values are entered into Table 3.18-7.

Calculation of Trucking Fatality Rate, No Action Alternative

1. Fatalities per ton-mile transported: 9.22×10^{-9}

   Source: California State Fire Marshall, Hazardous Liquid Pipeline Risk Assessment, April 1993

2. Correction to fatalities per barrel-mile transported:

   $$\frac{9.22 \times 10^{-9} \text{ fatalities/ton-mile}}{6.8 \text{ barrels/ton}} = 1.4 \times 10^{-9} \text{ fatalities/barrel-mile}$$

3. Calculation of barrel-miles/year:

   2014: 101 trucks/day x 275 miles/trip x 190 bbls/truck x 365 days/year = 19.3×10^{8} bbl-miles/year.

   2026: 128 x 275 x 190 x 365 = 2.40×10^{9} bbl-miles/year

4. Calculation of number of fatalities per year:

   2014: 19.3×10^{8} bbl-miles/year x 1.4×10^{-9} fatalities/bbl-mile = 2.7 fatalities/year

   2026: $2.4 \times 10^{9} \times 1.4 \times 10^{-9} = 3.4$ fatalities/year

These values are entered into Table 3.18-7.

Calculation of Barge Spill Rate, No Action Alternative

1. Spills per billion barrels transported:

Spills not involving hull rupture (leaks), 6.81 x 10^{-9}/ bbl transported
Spills involving hull rupture (ruptures), 1.3 x 10^{-9}/ bbl transported

Sources:
1) Minerals Management Service, Oil Spill Risk Analysis: Northern California (proposed sale 91) Outer Continental Shelf, US Dept. of the Interior, August 1987.
2) Minerals Management Service, Final EIS, Proposed Southern California Lease Offering, April 1984.
3) Minerals Management Service, Final EIS, OCS Sale 73, proposed 1983 OCS Oil and Gas Lease Sale Offshore Central California, June 1983

2. Barges on Columbia River (from No Action Alternative project description):

2014, 346 barge trips/year,
2026, 600 barge trips/year,

3. Calculation of Leak Rate:

2014, 6.81 x 10^{-9} leaks/bbl transported x 2.25 x 10^{6} bbl transported/year
= 155 x 10^{-3} = 0.153 leaks/year
2026, 6.81 x 10^{-9} x 25.8 x 10^{6} = 0.175 leaks/year

6. Calculation of Rupture Rate:

2014, 1.30 x 10^{-9} ruptures/bbl transported x 22.8 x 10^{6} bbl transported/year
= 0.029 ruptures/year
2026, 1.3 x 10^{-9} x 25.8 x 10^{6} = 0.034 ruptures/year

These values are entered into Table 3.18-8.

Calculation of Projected Spill Rate of Existing Olympic Pipeline

1. Projected spill rate for pipeline built 1997, and aged to 25-30 years old, spill rate:

Whatcom County to Allen Station - 16" dia., 37 miles
Allen Station to Renton Station - two lines, 16" and 20" dias., 78 miles
Renton Station to SeaTac airport - 12" dia., 6 miles
Renton to Harbor Island - 12" dia., 12 miles
Renton to Vancouver/ Portland - 14" dia., 150 miles

Assume average diameter of 14 ":
14" dia. - Leak probability = 4.9×10^{-4} per mile per year
Rupture = 2.1×10^{-4} per mile per year

(Source: Table 3.18-4 of this EIS)

2. Existing pipeline length = 375 miles. Constructed 1965.

3. Factor for 1960s year of construction, using Mastrandea (1982) spill rate for 1960 year of construction:

Leaks: $\text{1960s/new} = \dfrac{1.8 \times 10^{-3}}{4.9 \times 10^{-4}} = 3.7$

Ruptures: $\text{1960s/new} = \dfrac{9 \times 10^{-4}}{2.1 \times 10^{-4}} = 4.3$

4. Calculation of spill rate:

Leaks: 375 miles x 3.7 age factor x 4.9×10^{-4} leaks/mile/year = 0.68 leaks/yr

Ruptures: 375 x 4.3 x 2.1×10^{-4} = 0.34 ruptures/yr
Total 1.02 spills/yr

SUMMARY OF PIPELINE SPILL SCENARIOS

Scenario No.	Milepost	Spill Size (gal)*	Between Block Valves	Vol. Between Block Valves (gal)	% of Volume Spilled
1	0.8	1. 54,600 2. 13,500	1-2	310,000	18 4
2	7.9	1. 96,000 2. 13,650	1-2	310,000	31 4
3	19.0	148,400	5-6	279,426	53
4	34.0	100,700	9-10	124,068	81
5	38.2	20,000	11-12	70,350	28
6	55.0	29,400	14-15	495,642	6
7	59.0	162,100	14-15	495,642	33
8	94.5	1. 67,900 2. 9,300	20-21	158,046	43 6
9	108.0	35,550	21-22	430,920	8
10	145.0	13,100	25-26	605,556	2
11	174.5	11,700	29-30	766,836	2
12	212.5	49,800	33-34	1,265,124	4
					avg. = 21.5%

* 1. = short term
2. = long term

Source: Product Spill Analysis prepared by Dames & Moore, Feb. 28, 1997.

HISTORICAL U.S. OIL SPILL INCIDENTS IN THE 1980-1998 TIME FRAME

One of the most sensitive concerns about the proposed project is the potential for oil spill from the operating pipeline somewhere between Snohomish County and Pasco, and the effects of such a spill on the environment, including water quality, water supply, groundwater, fisheries and public health and safety. Some discussion of spill scenarios is included and/or referenced in the text of the EIS. These are hypothetical incidents, as all scenarios are, wherein each element of each scenario is made up, based on some reasonable information.

The EIS examines potential impacts of oil spills and leaks. It presents leak and accident probabilities of the proposal comparing the potential spill probabilities of truck accident, barge accident and pipeline accident. It refers to various oil spill scenarios and their potential impacts with various response scenarios. All of these analyses use professional judgement and scientific analysis to predict the future; the future of spill frequency, spill size, spill location, response activities, and other forecasts. There are infinite scenarios and it is as easy to generate a worst case scenario for the proposal (50,000 barrel pipeline spill into Lake Keechelus) as it is for No Action (50,000 barrel spill into Puget Sound or the Columbia River from barges). Decision makers must evaluate these forecasts and consider their likelihood vs. their impact.

One aspect of this project is that refined petroleum product will be transported in Washington with or without the project, and decision makers, with consideration for public comment and scientific analysis, must decide whether this project will have more or less potential impact than No Action or would create unacceptable impacts regardless. There will be oil spills in the future, and traffic accidents in the future, with or without the project. This EIS attempts, in as many ways as possible, to inform the reader about the potential for and significance of impacts.

To provide further context for the reviewer, this section lists various actual spill incidents involving barges, pipelines, trucks, and terminals. The following information does not depend on probability analysis, assumptions on size of effect, response time, location, or likelihood. All of the following incidents actually occurred. The reviewers can arrive at their own conclusions as to this information's applicability to the decision and to the Cross Cascade Pipeline Project. It includes examples of the types of spills that will occur with and without the project. The reader can then consider the risk analysis, the scenarios, the impact assessment, the No Action conditions, and these actual spill events, in balancing the risks and benefits of approval vs. denial.

The following information is not intended to be complete but is a sample of petroleum transport product spills that have occurred in the U.S. since 1980. Petroleum spills from non-petroleum transport means (e.g., cargo ships) are not included unless associated with transfer activity.

Tables at the end of the section also provide spills in context with the volumes carried by various carriers. Pipelines, which are sometimes accused of spilling the most oil of all oil transport systems, carry the most oil of all transport systems: 53-57% of the crude and refined oil transported. Tanker ships and barges carry about 40% of the volumes transported. Trucks carry 2-3% and rail carries about 1.5%. In 1994 there were 200,000 miles of oil pipelines operating in the U.S. and 244 incidents causing 1,858 injuries. Of all spills worldwide from 1987 through 1996, barges spilled

an average of 2-5 million gallons each year with a high of 6 million gallons twice in that period. Pipelines, which carry much more product, averaged spills of 3-6 million gallons per year and had three years with approximately 11 million gallons spilled and two years of 40 million gallons, worldwide.

According to the Oil Spill Intelligence Report (OSIR 1996), for the five year period ending in 1996, barge spills averaged 40,000 bbls per incident for three years and 440 bbls per incident for two years. Pipelines during the same period averaged 1,333 bbls per incident.

The following incidents occurred in U.S. waters.

Tidewater Barge Lines Inc. Spills

October 14, 1993 - Approximately 3,000 gallons of diesel fuel was spilled into the Columbia River from a barge ruptured by a rock on the Snake River. Other Tidewater Barge spills between 1986 and 1995 are shown below.

Date of Spill	Product	Qty. Spilled (gals)
5/24/95	gas	1
10/14/94	diesel	3,925
8/12/94	diesel	1
11/21/93	gas	1
7/16/93	diesel	2
11/26/92	gas	1
9/19/92	diesel	370
4/8/91	gas	15
2/12/91	diesel	50
3/21/90	diesel	3
7/24/89	diesel	1
6/12/89	gas	6
5/10/89	diesel	20
4/11/89	diesel	40
9/10/88	diesel	125
2/9/88	diesel	150
7/24/86	gas	60
2/3/86	jet diesel	150
1/30/86	#6 fuel	1

Barge Spill/Accident Incidents (Other than Tidewater)

April 1971 - A United Transportation barge spilled 230,000 gallons of refined product in Puget Sound, Skagit County.

May 1984 - The Barge "Offshore 2403" spilled 117,000 gallons of JP5 jet fuel off the Pacific Coast.

February 1986 - The barge "Apex Houston" spilled 26,000 gallons of oil.

January 1988 - 70,000 gallons of Bunker C oil was spilled offshore of Skagit County by a barge (MCN#5) owned by Olympic Tug and Barge.

December 1988 - The barge "Nestucca" ruptured and sank in a collision and spilled 231,000 gallons of Bunker C oil off the Washington coast. Nearly 10,000 waterfowl were killed and 95 miles of shoreline affected.

June 3, 1993 - Approximately 3,000 gallons of fuel was spilled into the Columbia River during fueling operations at the Port of Longview.

December 1994 - The Crowley barge 101 spilled 29,400 gallons of diesel fuel into Rosario Strait.

January 1996 - The barge North Cape, carrying 4 million gallons of heating oil, foundered after its tow tug caught fire. It washed up on a Rhode Island beach spilling 800,000 gallons, killing 14,000 lobster, and forcing closure of 254 square miles of fishing grounds for months.

January 1, 1998 - Several thousand gallons of fuel oil spilled from the decks of a Russian cargo vessel into Commencement Bay, Puget Sound near Tacoma when taking on fuel from a barge owned by Olympic Tug and Barge company.

February 17, 1998 - A tug towing two barges out the Strait had a mechanical problem and had to be rescued. One barge was picked up by another tug after several attempts under storm conditions. The other barge was not intercepted until it drifted across the Strait and was picked up near Vancouver Island by the Canadian Coast Guard.

Pipeline Spill/Accident Incidents

January 1973 - The Trans Mountain Pipeline ruptured and spilled 460,000 gallons of crude oil bound for the northwest refineries.

March 6, 1980 - There were pipeline failures on the Colonial Pipeline Company line in Manassas and Locust Grove, Virginia.

April 16, 1980 - Williams Pipeline Company gasoline line exploded and burned at Roseville, Minnesota.

January 30, 1980 - There was a petroleum products rupture and fire of the Puerto Rico Pipeline Company in Bayamon, Puerto Rico.

July 23, 1985 - The Continental Pipe Line Company line ruptured and burned in Kaycee, Wyoming.

July 8, 1986 - The Williams Pipe Line Company pipeline ruptured in Mounds Views, Minnesota.

November 1992 - The Chevron pipeline in Lincoln County, Washington released 20,000 gallons of jet fuel.

Tanker Truck Spill/Accident Incidents

February 13, 1991 - A gasoline semi-trailer with cargo tank overturned on I-5 south of downtown Seattle, spilled gasoline and caught fire, closing the freeway for three hours.

January 9, 1996 - A loaded gasoline tanker truck was hit by a train and knocked over in Bergen County, New Jersey near the George Washington Bridge. There was no spill and no fire.

May 11, 1996 -A gasoline tanker crashed in Eau Clair, Wisconsin spilling 3,700 gallons of gasoline into Otter Creek, about 1 mile upstream of the Eau Clair River. Dead fish were observed.

June 30, 1997 - A gasoline tanker truck spilled 5,000 gallons of gasoline in an accident in Chamblee, Georgia. Businesses and homes were evacuated and gasoline entered a creek.

September 16, 1997 - A gasoline tanker truck spilled 6,000 gallons of gasoline after overturning on Highway 68 near Taos, New Mexico; another motorist was seriously injured after hitting the overturned truck.

October 9, 1997 - A gasoline tanker collided with a front end loader in Lexington, Kentucky, East of I-75, spilling 2,000 gallons of gasoline, some of which entered Boone Creek.

November 21, 1997 - A gasoline tanker involved in an accident leaked gasoline onto the Schuylkill Expressway, causing a traffic jam that lasted for hours.

April 15, 1998 - A gasoline double-tanker truck crashed into an asphalt refinery in Portland, spilling 9,100 gallons of gasoline, killing the driver and causing a fire.

May 18, 1998 - A tanker truck carrying kerosene turned over on Highway 174 in Nevada, spilling 500 gallons of product.

May 1998 - A gasoline tanker truck left the roadway on I-95 in Philadelphia, hitting a tour bus, entering the oncoming lanes with a crash and fire that killed the driver and another passenger car driver, and burned an overpass so severely that it had to be replaced, closing I-95 for more than two months.

June 4, 1998 - a pickup truck collided with a full gasoline tanker in Delaware, causing the truck to turn over, burn and close the state highway for 2 days.

June 16, 1998 - A tanker truck carrying diesel fuel overturned, spilling its contents into the San Luis Rey River off Highway 76 near San Diego.

June 17, 1998 - A tanker truck collided with another truck in Forsyth, Illinois, resulting in a fuel spill into Stevens Creek.

June 18, 1998 - A train collided with a loaded gasoline tanker truck near Dallas, Texas, knocking over the cab and pushing the tank off the road. There was no spill.

July 1998 - two were killed when a tanker truck hit a bridge support over I-40 in North Carolina, collapsing the bridge onto the truck from the heat of the fire.

August 7, 1998 - A tanker truck overturned and burned on SR 836 in Florida, critically injuring the driver and burned through the road.

Product Terminal/Refinery Spill/Accident Incidents

February 1990 - The Navy Supply Depot in Kitsap County spilled 70,000 gallons of diesel fuel.

December 6, 1996 - 49,000 gallons of gasoline spilled from a failed coupling during a product transfer from the Olympic Pipeline. The spill occurred at the GATX terminal at Harbor Island in Seattle.

March 1990 - Texaco refinery at Marche Point spilled 130,000 gallons of diesel fuel.

January 1991 - 60,000 gallons of crude oil was spilled from a pipeline near Commencement Bay by U.S. Oil in Tacoma.

February 1991 - 210,000 gallons of crude oil was spilled from the Texaco refinery at Marche Point.

October 1993 - The U.S. Oil Company refinery in Tacoma spilled 264,000 gallons of crude oil.

December 1996 - 49,000 gallons of gasoline was spilled onto the ground at the GATX terminal on Harbor Island, Seattle.

August 5, 1997 - 1,300 gallons of marine fuel oil and jet fuel were spilled into the Strait at the Tosco Ferndale refinery from a sump when a valve was left open.

Tanker Ship Spill/Accident Incidents

The U.S. Coast Guard concluded in 1992 (Department of Transportation December 1992) that double hull tankers will prevent spills in all but the most severe incidents.

March 1989 - The crude oil tanker Exxon Valdez went aground and spilled 11,000,000 gallons of crude oil.

December 1980 - The tanker ship John A. McCone spilled 84,000 gallons of heavy crude oil off the Pacific Coast.

March 19, 1984 - The oil tanker SS Mobil Oil spilled 200,000 gallons of fuel oil into the Columbia River after grounding near St. Helens, Oregon.

October 1984 - The tanker "Puerto Rican" spilled between 1-1.4 million gallons of refined lube oil product off the Pacific Coast.

December 1985 - The tanker Arco Anchorage spilled 239,000 gallons of crude oil at Port Angeles.

February 1990 - The tanker American Trader spilled 394,000 gallons of light crude oil off the Pacific Coast.

October 1990 - The tanker Contessa spilled 81,000 gallons of diesel off the Pacific Coast.

May 12, 1996 - The crude oil tanker ANITRA spilled 40,000 gallons of crude while offloading cargo in Delaware Bay, Pennsylvania.

October 22, 1996 - The oil tanker Arcadia lost steering near Rosario Strait while carrying 10.5 million gallons of crude. It crossed in front of another oil tanker before turning around.

Olympic Pipe Line Company Spills Since 1983

The following information as reported in the literature and Table A-1 list OPL spills. Conflicts with the data have not been reconciled.

September 1983 - 168,000 gallons of diesel fuel was spilled at the Allen Pump station.

November 1985 - 31,000 gallons of jet fuel spilled into Des Moines Creek near Sea-Tac Airport south of Seattle.

Table A-1. Petroleum Release History, Olympic Pipeline, 1966 - 1997

Date	Location	Cause	Product	Loss (BBLs)	Recovered (BBLs)
8-24-66	12" Seattle	3rd Party	Gasoline	160	140
1-23-68	So Po DF	3rd Party	Gasoline	10	10
2-2-68	Seattle DF	2" Gasket	Turbine	5	0
2-19-70	Olympia Junction	12" Gasket	Diesel	19	10
3-15-71	Sea-Tac	12" Gasket	Turbine	30	20
3-8-72	Renton Station	16" Gasket	Diesel	5	4.5
3-17-82	Renton Station	Pressure Gauge	Turbine	6	5.5
7-23-72	Fern Station	16" Gasket	Diesel	5	4
9-6-72	Woodinville Station	Sample Line	Diesel	10	10
9-15-72	Olympic Junction	12" Gasket	Diesel	2	0
3-22-73	Sea-Tac	Prover Gasket	Turbine	4	1
3-26-73	MP 84.5 of 20" Line	3rd Party	Gasoline	215	180
12-21-73	Allen Station	16" Gasket	Diesel	8	8
8-8-75	Allen Station	20" Gasket	Diesel/Gasoline	570	502
12-1-75	65.5 MP of 20" Line	Sensing Line	Turbine	12	7
7-21-78	Renton Station	O-Ring Gasket	Gasoline	1.5	0
3-13-79	So Po DF	Corrosion	Diesel	1,700	1,590
6-19-80	Renton Station	Small Piping	Diesel	1	0
8-18-80	Allen Station	Pressure Cell	Diesel	4	0
2-24-81	Woodinville Station	Fitting	Gasoline	5	4
9-26-81	Vance Junction	3rd Party	Gasoline	5	2
8-14-83	Allen Station	Flange Gasket	Diesel/Turbine	1,019	870
6-10-84	Olympia Lateral	3rd Party	Diesel	224	145
8-23-85	MP 46 of 20" Line	Sensing Line	Diesel	740	524
11-24-85	Sea-Tac	Filter Valve	Turbine	500	440
12-24-85	Seattle DF	Flange Gasket	Diesel	60+	60+
7-17-86	MP 114 of 14" Line	3rd Party	Diesel	820	740
9-30-86	MP 110 of 16" Line	Sensing Line	Mixture	2,000	unknown
5-15-87	Vance DF	Operator Error	Diesel	5	5
8-23-88	Allen Station	Mainline Rupture	Diesel	4,000	2,300
8-12-89	MP 119.0 of 14" Line	Block Valve Plug	Unknown	unknown	1
2-7-90	Woodinville Station	16" Gasket	Diesel	300	100

Table A-1. Continued

Date	Location	Cause	Product	Loss (BBLs)	Recovered (BBLs)
2-26-91	Sea-Tac Terminal	Differential Gauge	Turbine	10	8
1-24-92	Olympic Sta/Jct	Circulation Line	Diesel	75	60
2-17-92	Tacoma Station	Circulation Line	Diesel	2	2
3-1-92	Olympic Sta/Jct	Circulation Line	Diesel	10	unknown
10-30-92	Renton Station	T/I Gasket	Turbine	50	45
7-18-93	Renton Station	Gasket	Diesel	5	5
6-20-94	Tacoma Station	Thermo Well Failure	Diesel	55	50+
3-23-96	14" MP 227	Natural Forces	Diesel	10	5
6-17-96	20" MP 74.2	Buckle in Pipe	Diesel/Gasoline	20	11
5-27-97	Castle Rock Station	Seal Failure	Diesel/Gasoline	263	250

May 1986 - 70-80,000 gallons of product leaked from the line in the Renton area of South King County (a possible source of groundwater contamination which showed up in April, 1998). The 1986 spill of gasoline, jet fuel and diesel fuel caused nine families to be evacuated.

February 23, 1988 - 168,000 gallons of diesel fuel spilled from a pipeline rupture at the Allen Station. The product was contained in an adjacent field and none reached surface waters.

February 7, 1990 - 12,000 gallons of diesel fuel spilled from a failed gasket at the Woodinville pump station. No product reached surface waters.

January 24, 1992 - About 3,000 gallons of diesel fuel spilled from a ruptured fitting at the Rainier pump station. No product reached surface waters.

October 30, 1992 - Approximately 2,000 gallons of turbine lubricating oil spilled from a gasket at the Renton Station. Product was contained on site. No product reached surface waters.

June 20, 1994 - More than 4,000 gallons of diesel fuel spilled from an equipment monitor probe connection at the Spanaway pump station. No product reached surface waters.

March 23, 1996 - Olympic Pipeline leaked near Kalama as a result of ground movement after extensive rains. The slide moved and cracked the line. The leak was discovered when a resident detected oil in Spencer Creek in Cowlitz County.

June 17, 1996 - Olympic Pipeline leaked at least 1,000 gallons of gasoline and diesel due to a small crack in their line near Everett, next to Ebey Slough.

Appendix B. Table B-1. Summary Table of 72 Wetlands Impacted by Pipeline Construction[a]

Wetland No.	Approx. Size (acre)	Wetland Category	Impact Area by Vegetation Class (acre)					Common Plant Species in Construction Corridor	Federal Lands
			PFO	PSS	PEM	OW	Total		
Total	635		0.54	9.46	4.93	0.61	15.54	RUSP, Salix, TYLA, PHAR	
Snohomish County									
CountyTotal	147		0.03	2.87	1.31	0.05	4.26		
270522A	10	I	0	0	0.21	0	0.21	RUSP, TYLA, PHAR, Salix	
270522D	6	II	0	0.72	0	0	0.72	PHAR, TYLA, JUEF	
270523	14	I	0	0.65	0	0	0.65	SPDO, Salix, RUSP	
270523A	6	I	0	0.15	0	0	0.15		
270524B	5	II	0	0	0.11	0	0.11	PLLA, AGAL	
270619A	1	III	0	0.02	0	0	0.02	RARE, EPAN, RUSP, ACCI	
270619C	3	I	0	0.10	0	0	0.10		
270619B	45	I	0	0.65	0	0	0.65	PHAR, RUSP, Salix	
270620E	5	I	0	0.11	0.04	0	0.15	JUEF, PHAR, AGAL, RUSP, ALRU, SPDO	
270628	20	I	0	0.26	0.17	0	0.43	PHAR, RUSP, SPDO, POTR	
270621A	6	I	0	0	0.10	0	0.10	LYAM	
270621C	1	I	0	0.09	0	0	0.09	SPDO, RUSP, SALA	
270621B	4	I	0	0	0	0.02	0.02		
270627	2	III	0	0	0.14	0	0.14	TYLA, JUEF	
270626B	0.4	III	0	0	0.03	0	0.03	JUEF, RARE	
270626C	0.3	III	0	0.3	0	0	0.3	POTR, JUEF, RARE	
270625B	1	IV	0	0.03	0	0	0.03	ALRU, PHAR	
270730	3	II	0	0.26	0	0	0.26	RUSP, ALRU, SALA	
270720	1	I	0	0.03	0	0	0.03	RUSP, POTR, ALRU	

Table B-1. Continued

Wetland No.	Approx. Size (acre)	Wetland Category	Impact Area by Vegetation Class (acre)					Common Plant Species In Construction Corridor	Federal Lands
			PFO	PSS	PEM	OW	Total		
270729	3	1	0.03	0	0	0	0.03	ALRU, THPL, RUSP, POTR, SCMI	
270732B	9	1	0.28	0	0	0	0.28	RUPA, SPDO, TYLA, PHAR	
King County									
County Total	132		0.51	4.44	0.09	0.03	5.07		
260709	26	1	0	0.52	0.09	0	0.61	PHAR, JUEF, ACCI, RUPA, SPDO	
260716	7	1	0	0.18	0	0	0.18	Salix, PHAR	
260717	5	1	0	0.28	0	0	0.28	RUSP, SPDO, TYLA, PHAR	
260727A	11	I	0	0.34	0	0	0.34	RUSP, ALRU, SPDO, PHAR	
260734	6	1	0	0.05	0	0	0.05	RUSP, SPDO, TYLA, PHAR, POTR	
260735	12	I	0	0.46	0	0	0.46	RUSP, SPDO, TYLA, PHAR, ALRU	
250702C	1	II	0	0.12	0	0	0.12	RUSP, SPDO, POTR, ALRU	
250702B	1	III	0	0.15	0	0	0.15	ALRU, THPL, SPDO, PHAR, SCMI,	
250702A	6	III	0	0.34	0	0	0.34	RUSP, SPDO, ALRU, SCMI, JUEF, POTR	
250714	9	1	0.17	0.05	0.03	0	0.25	THPL, ALRU, POTR	
250725C	1	III	0	0.14	0	0	0.14	RUPA, SPDO, TYLA, ALRU, ACCI, Salix	
250725D	2	II	0	0.34	0	0	0.34	RUPA, SPDO, TYLA, ALRU, POTR, ALRU, SCMI	
250725E	3	II	0	0.53	0	0	0.53	RUPA, SPDO, TYLA, POTR, ALRU, SCMI	
250736	6	II	0	0.15	0	0	0.15	POTR, ALRU, JUEF	
250736A	2	III	0	0.20	0	0	0.20	RUPA, SPDO, TYLA, POTR, JUEF	
240806	20	1	0.15	0	0	0	0.15	POTR, PSME, PISI, RUSP	
240807	8	I	0.19	0	0	0	0.19	POTR, PISI, PSME, RUSP, SPDO	
221013	6	II	0	0.59	0	0	0.59	POTR, ALRU, RUSP, THPL, Salix	USFS

Table B-1. Continued

Wetland No.	Approx. Size (acre)	Wetland Category	Impact Area by Vegetation Class (acre)					Common Plant Species in Construction Corridor	Federal Lands
			PFO	PSS	PEM	OW	Total		
Kittitas County									
County Total	228		0	1.44	1.96	0.02	3.42		
201309	24	1	0	0.07	0	0	0.07	ALRU, EQAR, SCM1	
191403	1	111	0	0	0.08	0	0.08	TYLA, SCM1	
191401A	112	11	0	0.81	0.73	0	1.54	PHAR, SCM1, ALS1	
191504	3	11	0	0	0.29	0	0.29	POPR, JUEF	
191608	1	111	0	0	0.08	0	0.08	TYLA, SCAC	
191611A	1	111	0	0	0.08	0	0.08	EQAR, POPR, RUCR	
191611B	3	11	0	0	0.02	0	0.02	EQAR, POPR, TYLA	
191723	3	11	0	0.05	0	0	0.05	POTR, EPAN, Salix	
191821A	15	11	0	0.09	0.32	0.01	0.42	JUEF, TRPR, PHAR, SAEX, CRDO	
191835	23	11	0	0.24	0.09	0	0.33	JUEF, SCM1 SAEX	
181918	13	11	0	0.02	0	0	0.02	SAEX	
181919	15	11	0	0	0.23	0	0.23	JUEF	
171904	3	11	0	0.04	0	0	0.04	SAEX	
172008A	1	111	0	0.04	0	0	0.04	JUEF, PHAR, POTR	
172008B	1	11	0	0	0	0.01	0.01	PHAR, SAEX	
172016	4	11	0	0	0.04	0	0.04	JUEF, Carex	
172023[b]	2	111	0	0.02	0	0	0.02	SAEX, POTR, TYLA, PHAR	
162318[b]	3	11	0	0.06	0	0	0.06	SAEX, POTR, PHLE	DOD

Table B-1. Continued

Wetland No.	Approx. Size (acre)	Wetland Category	Impact Area by Vegetation Class (acre)					Common Plant Species In Construction Corridor	Federal Lands
			PFO	PSS	PEM	OW	Total		
Grant County									
County Total	65.5		0	0	1.20	0.27	1.47		
162419	6	II	0	0	0.14	0	0.14	TYLA, SCAC, DIST, ELAN	BOR
162417[b]	6	II	0	0	0.07	0	0.07	TYLA, DIST, ELAN	
162416	2	II	0	0	0.17	0	0.17	TYLA, DIST	
162415	2	II	0	0	0.03	0	0.03	TYLA, DIST, ELAN	BOR
162413	4	II	0	0	0.03	0	0.03	TYLA, SCAC, JUEF	
162412	5	III	0	0	0.07	0	0.07	PHAR, TYLA, HOJU	
162414	0.5	III	0	0	0.14	0	0.14	DIST	BOR
162735A	3	I	0	0	0.17	0	0.17	TYLA	
172537B	32	I	0	0	0.38	0.03	0.41	TYLA, SCOL	
162736	5	I	0	0	0	0.24	0.24	DIST	
Adams County									
County Total	4		0	0	0.07	0.21	0.28		
152806A	1	I	0	0	0.07	0	0.07	DIST	
152806B	3	III	0	0	0	0.21	0.21	DIST, SCOL	
Franklin County									
County Total	58		0	0.71	0.30	0.03	1.04		
142812	9	II	0	0.66	0	0	0.66	TYLA, SCAC, SAEX	BOR
132911A	33	II	0	0	0.02	0	0.02	PHAR, DIST, HOLA, ELAN	BOR
132925D	5	III	0	0	0.13	0	0.13	TYLA, SCAC	BOR
132925B	1	III	0	0	0.05	0	0.05	SCAC, ELAN	BOR
112901	5	III	0	0	0.10	0	0.10	PHAR, TYLA	BOR

Table B-1. Continued

Wetland No.	Approx. Size (acre)	Wetland Category	Impact Area by Vegetation Class (acre)					Common Plant Species in Construction Corridor	Federal Lands
			PFO	PSS	PEM	OW	Total		
102924	5	II	0	0.05	0	0.01	0.06	ELAN, TYLA, EPWA	

[a] Six additional wetlands would be impacted by the proposed route as shown in the May 1998 ASC; information to be included in this table was not available at the time the DEIS was printed.
[b] These three wetlands would be avoided by the proposed route as shown in the May 1998 ASC.

Source: Dames & Moore 1997.

Blank: No information on plants provided in Dames & Moore 1997.

Notes: BOR = U.S. Bureau of Reclamation administered federal lands
DOD = U.S. Department of Defense (Yakima Training Center) administered federal lands
USFS = U.S. Forest Service administered federal lands

Common Plant Species Code:
ACCI = vine maple (*Acer circinatum*)
AGAL = red-top (*Agrostis alba*)
ALRU = red alder (*Alnus rubra*)
ALSI = Sitka alder (*Alnus sinuata*)
CRDO = Douglas' hawthorn (*Crataegus douglasii*)
DIST = saltgrass (*Distichlis stricta*)
ELAN = Russian olive (*Elaegnus angustifolia*)
EPAN = fireweed (*Epilobium angustifolium*)
EPWA = Watson's willow-herb (*Epilobium watsonii*)
EQAR = common horsetail (*Equisetum arvense*)
HOLA = velvetgrass (*Holcus lanatus*)
HOJU = fox-tail barley (*Hordeum jubatum*)
PJUEF = soft rush (*Juncus effusus*)
LYAM = skunk cabbage (*Lysichitum americanum*)
PHAR = reed canarygrass (*Phalaris arundinacea*)
PHLE = mockorange (*Philadelphus lewisii*)
PLLA = English plantain (*Plantago lanceolata*)
POPR = Kentucky bluegrass (*Poa pratensis*)
POTR = black cottonwood (*Populus trichocarpa*)
PSME = Douglas-fir (*Pseudotsuga menziesii*)
RARE = creeping buttercup (*Ranunculus repens*)
RUPA = thimbleberry (*Rubus parviflorus*)
RUSP = salmonberry (*Rubus spectabilis*)
RUCR = curly dock (*Rumex crispus*)
SAEX = sandbar willow (*Salix exigua*)
SALA = Pacific willow (*Salix lasiandra*)
SCAC = hardstem bulrush (*Scirpus acutus*)
SCMI = small-fruited bulrush (*Scirpus microcarpus*)
SCOL = Olney's bulrush (*Scirpus olneyi*)
SPDO = Douglas' spirea (*Spiraea douglasii*)
THPL = western red cedar (*Thuja plicata*)
TRRE = white clover (*Trifolium repens*)
TYLA = common cattail (*Typha latifolia*)

Vegetation Class Code:
PFO = palustrine forested
PSS = palustrine scrub-shrub
PEM = palustrine emergent
OW = open water and/or riverine

Appendix B. Table B-2. Hydrogeomorphology and Risk of Hydrologic Change to Wetlands

Wetland Number	Hydrologic Input	Shape	Size	Geology	Soils	Risk of Drainage through Trench	Risk of Drainage through Subsoil	Federal Lands
270522A	GW/SR	S	M	Qgt	McKenna Silt Loam	Yes	No	
270522D	SR/STRM	D	L	Qgo	Alderwood Loam	No	Yes	
270523	GW/SR	D	L	Qgt	Alderwood loam	Yes	No	
270523A	STRM	D	L	Qgt	Alderwood loam	No	No	
270524B	SR	D	L	Qgt	Norma Loam	No	No	
270619A	STRM/SR	O	M	Qgt	Alderwood Loam	No	No	
270619C	SR	D	L	Qgo	Alderwood loam	No	Yes	
270619B	STRM/SR	O	L	Qgo	Alderwood Mukilteo	No	Yes	
270620E	SR	D	L	Qgt	Alderwood Loam	No	No	
270628	SR	D	L	Qgt	Mukilteo	No	No	
270621A	STRM	F	L	Qgt	Alderwood	No	No	
270621C	GW/SR	D	L	Tb	Alderwood	No	No	
270621B	STRM	F	L	Qgt	Alderwood	No	No	
270627	SR	D	M	Qgt	Alderwood	No	No	
270626B	SR	D	M	Qgt	Alderwood-Everett	No	No	
270626C	GW/SR	D	S	Qa	Gravel pit	No	No	
270625B	SR/GW	D	S	Qgo	Puget Loam	No	No	
270730	SR	D	M	Qgt	Tokul Loam	No	No	
270720	STRM/SR	F	M	Tan	Tokul Loam	No	Yes	
270729	STRM/SR	F	L	Tan	Mukilteo Muck	No	Yes	
270732B	SR	D	L	Tan	Tokul Loam	Yes	Yes	
260709	STRM	F	L	Qgo Qa	Kitsap Silt Loam	No	No	
260716	STRM	F	L	Qgt	Alderwood Kitsap	No	No	
260717	STRM/SR	F/D	L	Qgt	Alderwood Loam	No	No	
260727A	STRM	F	L	Qgo	Klaber Silt Loam	No	No	
260734	STRM/SR	D	L	Qgt	Tokul	No	No	
260735	SR	D	L	Qgt	Tokul Loam	No	No	
250702C	SR	D	S	Qgt	Tokul Loam	No	No	
250702B	SR	D	S	Qgt	Tokul Loam	No	No	
250702A	SR	D	M	Qgt	Tokul Loam	No	No	
250714	STRM	F	L	Qa	Riverwash	No	No	
250725C	SR	D	S	Qgt	Tokul	No	No	
250725D	SR	D	M	Qgt	Tokul	No	No	
250725E	SR	D	M	Qgt	Tokul	No	No	
250736	STRM	F	L	Qgo	Barneston Gravelly Sandy Loam	No	No	
250736A	SR/GW	S	L	Qgt	Tokul	Yes	No	
240806	STRM/SR	D	L	Qgt	Tokul Gravelly Loam	No	No	
240807	STRM/SR	D	L	Qgt	Tokul Gravelly Loam	No	No	
221013	GW/SR	S	M	Tg	Kaleetan	Yes	Yes	USFS

Table B-2. Continued

Wetland Number	Hydrologic Input	Shape	Size	Geology	Soils	Risk of Drainage through Trench	Risk of Drainage through Subsoil	Federal Lands
201309	STRM	F	L	Qa	Kachess	No	No	
191403	STRM/SR	F	M	Qa	Bertolotti Loam	No	Yes	
191401A	SR	D	L	Qa	Peat	No	No	
191504	STRM	D	M	Qa	Peoh Loam	No	Yes	
191608	STRM	F	M	Qgo	Swauk Loam	No	Yes	
191611A	SR/GW	D	S	Qls	Swauk Loam	No	Yes	
191611B	STRM	F	M	Qls	Swauk Loam	No	Yes	
191723	STRM	F	M	Qa	Weirman complex	No	No	
191821A	SW/STRM	D	L	Qa	Woldale Clay Loam	No	Yes	
191835	STRM/GW	F	L	Qa	Reecer-Sketter-Weirman complex	No	Yes	
181918	STRM	F	L	Tal	Wenas Loam	No	Yes	
181919	SR	D	L	Qa	Wenas Loam	No	Yes	
171904	STRM	F	L	Qa	Nanum Loam	No	No	
172008A	STRM	F	M	Qa	Terlan-Durtash-Selah complex	No	No	
172008B	STRM	F	M	Qa	Kittitas Silt Loam	No	No	
172016	STRM	F	L	Tb	Rollinger silt loam	No	No	
172023	STRM	F	M	Tb	Benwy silt loam	No	No	
162318	STRM	F	L	Qa	No data	No	No	DOD
162419	STRM/SR	F	L	Tb	Wanser-Quincy	No	No	BOR
162417	STRM/SR	F	L	Tre	Aquents ponded	No	Yes	
162416	SR	D	M	Tre	Wanser-Quincy	No	Yes	
162415	STRM	F	L	Tb	Wanser-Quincy Sand	No	No	BOR
162413	STRM	F	L	Tre	Kennewick Loam	No	Yes	
162412	SR/STRM	D	L	Qre	Kennewick Loam	No	Yes	
162614	GW/SR	D	S	Tb	Starbuck-Prosser	No	No	BOR
162735A	SR	D	L	Tb	Winchester sand	No	No	
162735B	STRM/SR	F	L	Qa	Aquents, ponded	No	No	
162736	SR/GW	D	L	Qa	Umapine silt loam	No	Yes	
152806A	SR/GW	D	L	Qfg	Red rock	No	Yes	
152806B	SR/GW	D	L	Qfg	Red rock	No	Yes	
142812	STRM/SR	D/F	L	Qs	Quincy-Hezel-Warden	No	Yes	BOR
132911A	STRM	F	L	Tb	Quincy-Quinton	No	No	BOR
132925D	SR	D	M	Tb	Starbuck-Prosser	No	No	BOR
132925B	SR/GW	D	S	Qs	Prosser-Starbuck	No	Yes	BOR
112901	SR	D	M	Trl	Quincy & Sagehill Loam	No	No	BOR
102924	STRM	F	L	Qa	Quincy Loam	No	No	

Table B-2. Continued

Wetland Number	Hydrologic Input	Shape	Size	Geology	Soils	Risk of Drainage through Trench	Risk of Drainage through Subsoil	Federal Lands

Hydrologic Input Codes
- STRM - Surface connection to stream, river or lake
- GW - Groundwater discharge
- SR - Surface runoff

Shape Codes
- D - Surface depressional
- F - Floodplain
- S - Slope
- O - Other

Size Codes
- S - Small (< .5 acre)
- M - Medium (.5 to 2 acres)
- L - Large (> 2 acres)

Geology Codes:
- Qa - Quaternary alluvium
- Qfg - Quaternary fluvial gravels
- Qgo - Quaternary glacial outwash
- Qgt - Quaternary glacial till
- Qls - Quaternary landslide deposits
- Qs - Quaternary fluvial and lacustrine sand
- Tal - Tertiary alluvium
- Tan - Tertiary andesite
- Tb - Tertiary basalt
- Tg - Tertiary granites
- Tre - Tertiary Ringold formation eolian silt and sand
- Trl - Tertiary Ringold formation lacustrine clay, silt, and fine sand

Notes: BOR = U.S. Bureau of Reclamation administered federal lands
DOD = U.S. Department of Defense (Yakima Training Center) administered federal lands
USFS = U.S. Forest Service administered federal lands

Information for six additional wetlands impacted by the proposed route as shown in the May 1998 ASC was not available at time of printing of DEIS.

Appendix C. Mitigation Measures and Best Management Practices

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Appendix C. Mitigation Measures and Best Management Practices

Note: This appendix is based on the May 1998 Application for Site Certification Agreement for the Cross Cascade Pipeline, Section 1.4, Mitigation Measures, with additional information from Section 2.15, Protection from Natural Hazards.

As further assurance that these activities actually occur (appearance in an EIS has no implicit enforcement), the Best Management Practices (BMPs) can be explicitly defined and described in one or more of the following documents:

- *Forest Service Record of Decision (ROD)*
- *Bureau of Land Management ROD*
- *Federal Permits*
- *BLM ROW Agreement*
- *EFSEC Site Certification Agreement*
- *OPL Plan of Development*
- *Inspection Checklist for Agency/Oversight Construction Inspectors*
- *OPL QA/QC Plan*

This appendix lists measures that are being proposed by OPL to minimize impacts. Additional mitigation suggested by the EIS team to further reduce impacts, beyond those measures listed below, is described in Chapter 3 of the EIS.

INTRODUCTION

The following describes measures which are proposed by OPL either as part of the Cross Cascade Pipeline project design or as potential mitigation to minimize possible adverse impacts on the physical or human environment. The measures are described by element of the environment. More detailed information on existing conditions, potential impacts and proposed mitigation measures is included in Section 2.9 Spill Prevention and Control, 2.10 Surface-Water Runoff, and Parts 3, 4, 5, 6, and 8 of OPL's Application for Site Certification (ASC).

GENERAL CONSTRUCTION MITIGATION PRACTICES

The following mitigation measures consist of Best Management Practices (BMPs) which will be applied to construction of the proposed facilities.

Erosion and Sediment Control BMPs

Construction progress and specific work activities are subject to the effects of terrain, topography, subsurface conditions, right-of-way width, and weather. It is not possible to predict exactly the time between initial right-of-way clearing and revegetation for any given corridor segment. However, the interval is usually one week or less based on experience with other pipeline projects. The following measures will be implemented to ensure that the interval is kept to the minimum amount necessary:

- Right-of-way clearing will be restricted to no more than three (3) days' worth of the average construction progress across the existing terrain.
- Opening of the ditch or trench will be restricted to no more than two (2) days' worth of the average construction progress.
- Unfinished right-of-way reclamation will be restricted to one week's worth of progress. Any right-of-way which cannot be reclaimed and revegetated within one week of the pipe laying and weld examinations will be treated to prevent or minimize erosion by maintaining the erosion control facilities and, where appropriate, by covering the right-of-way with mulch.

Construction practices will conform with the erosion control and sediment BMPs as set forth in the Stormwater Management Manual. The 13 general requirements for site erosion and sediment control are listed below and will be implemented as necessary.

- **Soil stabilization:** Exposed and unworked soils will be stabilized to protect soils from rain and flowing water. This includes such practices as vegetative cover, mulching, or the early application of a gravel base.
- **Site easement:** The limits of the construction area will be clearly marked, including the marking of any sensitive areas, buffers, trees and other vegetation to be retained and water courses.
- **Adjacent properties:** Adjacent properties will be protected from sediment deposition. This includes providing some type of barrier between the construction zone and adjacent properties which can include a natural vegetative buffer.

- **Timing:** One of the first steps of construction will be the construction of sediment control structures such as sediment traps and barriers. When feasible, these features will be in place prior to clearing of the area.

- **Slopes:** Cut and fill slopes will be designed and constructed to minimize erosion. Exposed slopes will be stabilized to prevent erosion. Stockpiles of erodible raw materials will be covered and bermed to prevent stormwater from entering stockpiles. If piles are so large that they cannot feasibly be covered and contained, erosion control practices will be implemented at perimeter of site and temporary sediment traps will be used to minimize offsite movement.

- **Down gradient control:** Offsite erosion will be controlled. In addition to Item #2 above, measures will be implemented for additional protection of downstream or downgradient properties or watersheds.

- **Conveyance channels:** If required, temporary conveyance channels will be designed, constructed and stabilized to prevent erosion from the expected velocity of flow from a 25-year, 24-hour frequency storm.

- **Storm drains:** If storm drain outlets are constructed, they will be protected so that stormwater runoff will not enter offsite stormwater systems without first being filtered or otherwise treated to remove sediment.

- **Utilities:** If underground utility construction is required, lengths open will be limited to 500' at any one time; excavated material will be placed on the uphill side of the excavation and trench dewatering will be directed into a sediment trap.

- **Site access roads:** Provisions will be made to minimize the transport of sediment onto paved road surfaces. If sediment is transported onto roads, it will be cleaned up at the end of each day.

- **Removal of BMPs:** All temporary erosion and sediment control measures will be removed within 30 days after the site's use as a construction staging area has ended and stabilization measures are in place and operating according to performance standards, unless there is a continuing need for the site for another project.

- **Dewatering:** In any area that has dewatering devices from exposed surfaces, the discharge will be directed into a sediment trap or some other type of filter system.

- **Pollutant control:** All other potential pollutants that occur or are used on site during construction (such as petroleum products) will be handled and disposed of in a manner which does not contaminate stormwater.

See Section 2.10 of the ASC, Stormwater Runoff, for a detailed discussion of the specific application of erosion and sediment control BMPs. A detailed, site-specific erosion and sediment control plan will be submitted to EFSEC prior to construction.

Construction at Water Crossings

- Secondary containment structures will be constructed (i.e., berms and filter fences) along with runoff dispersion and sediment traps to prevent any runoff generated in the staging areas from reaching the stream.
- Equipment will not be run into the stream channels such that stream bank and bed integrity is maintained.
- If a temporary stream crossing structure for equipment is needed, an appropriate structure will be designed and constructed prior to pipeline construction (see Section 2.14 of the ASC).
- The pipeline will be laid with a minimum of 2 feet of cover below scour depth.
- Stream waters will be diverted past the construction areas using temporary conveyance structures such as flume pipes, pumps, or coffer dams. The stream diversion will be designed and operated such that it does not cause erosion and scour of the stream channel and will be screened to preclude fish entry.
- Excavating will be conducted to avoid cave-ins and sloughing of the trench sides and river banks.
- The original gradient of the stream will be maintained following backfill and no spoils banks or other objects will be left in the channel.
- All areas disturbed by the construction will be stabilized by mulching, reseeding, or riprap placement, and excess spoils will be disposed of such that they do not re-enter the stream.

Directional Drilling

Directional drilling will be conducted at the Columbia River crossing.

- The setback distance on both banks of the Columbia River will exceed the recommended 100’ for potential flooding and erosion potential.
- Concentrated flows of water will be diverted from the drilling location by using sandbags, or other check dams.
- Temporary sediment traps may be used to catch sediments generated during the drilling.

- Soil cuttings and accumulated sediment will be disposed of by appropriate methods and exposed soils will be stabilized at the end of the job using mulch or other erosion control methods.

- Typical drilling fluid will be a bentonite water mix (e.g., 10 to 12 gallons/pound) and may contain additives as appropriate. Oil based fluids will not be used.

- All drilling fluids will be contained in basins which will be designed to hold all of the circulating fluids and which will be excavated on both sides of the crossing. In no situation will fluids be allowed to discharge from the basins or the surface of the drill site to any stream.

Road Crossings or Entrances

- Rock mats will be placed at entrances/exits to each site to minimize the amount of sediment accumulation on public roadways.

- Any sediment deposited on paved roads will be removed daily.

- Sediment will not be washed into existing catch basins.

Construction on Steep Slopes

- Check structures such as dikes and swales will be used to reduce runoff velocity on disturbed slopes and to divert surface runoff around and away from steep slopes.

- Dikes and swales may be constructed at the base, top, or horizontally across slopes as needed and the runoff will be diverted to a sediment trap.

- In areas with moderate to high erosion potential, filter fences, or a combination of filter fences and straw bales, will be installed to prevent sediment eroded from steep slopes and disturbed areas from entering a water body or leaving the construction site.

- Matting or netting may be used on steep slopes to prevent erosion.

- Mulching and prompt revegetation will be used to minimize erosion of exposed soils.

- Temporary diversions will remain in place until the slope is re-stabilized.

Permanent Stabilization at Pump Station Sites

- Immediately following construction at each site, the site will be revegetated using native, non-invasive plant species, or hydroseeded (where appropriate) using a grass and forb mixture recommended by the Natural Resources Conservation Service and the Washington Department of Fish and Wildlife.

- Access areas and areas surrounding control buildings may be graveled, depending on site conditions.

Stormwater Pollution Prevention

- Any stormwater runoff onsite will be directed to a sediment basin and allowed to evaporate.

- The containment structure will allow for infiltration and evaporation of the stored water.

- The detention basin will be sized appropriately to a minimum 25-year event, allowing for losses from infiltration.

- All erosion and sediment control BMPs will be inspected and maintained prior to and after major storms and on a routine basis. Control structures, if any are required, will be checked immediately following major rain events, any debris removed, and repairs made promptly.

- Appropriate storage areas for liquid chemicals (including pesticides and fertilizers), waste oils, solvents, or petroleum products will be maintained in designated locations at least 100 feet away from all water bodies and drainage ways. The storage areas will be placed on concrete or asphalt pads (impermeable) and will include secondary containment in the event of a leak or spill. The secondary containment will be sized such that all potentially leaked stored materials will be collected.

- Chemicals will be properly labeled and tight-fitting lids will be maintained on all containers.

- Containers will be raised off the ground on pallets or the storage area will be bermed to prevent stormwater from contacting the containers. Storage areas will be covered where feasible. Drip pans or equivalent absorbent materials will be placed at potential drip/spill locations during filling or unloading of containers and containers will be checked daily for leaks and spills. Any containers that are deteriorating will be immediately replaced.

- Spill cleanup materials will be stored and maintained on site in case of accidental release and employees will be trained in spill control procedures.

- Fertilizers generally will not be applied to areas immediately adjacent to water bodies or drainage pathways. If fertilizer is necessary near water bodies, fertilizer with little or no phosphorous will be selected if available. Local authorities will be consulted before applying fertilizer near any sensitive water body.

See Section 2.10 of the ASC, Stormwater Runoff, for further discussion of stormwater management and pollution prevention. A Stormwater Pollution Prevention plan will be submitted to EFSEC prior to construction.

PROTECTION FROM NATURAL HAZARDS

Protection Measures Against Fault Rupture

- Avoidance has been selected as the most effective mitigation measure against damage due to fault rupture.

- The pipeline will be constructed of welded high-grade steel which allows a significant amount of movement of the pipeline during ground displacement without rupturing the pipeline.

- To further take advantage of the ductility capacity of the pipe, the trench geometry can be altered if necessary.

- Depending on the length of pipe impacted, a soil-pipe interaction analysis will evaluate induced stresses and strains for various backfill configurations. Based on the analysis results, combinations of pipe wall thickness, backfill compaction and trench geometry can be evaluated that will accommodate the expected displacement thereby protecting the pipe from damage.

- Alternatively, an active mitigation measure is to place block valves on both sides of the fault.

- The pipeline corridor has been located to avoid the portion of the Saddle Mountains fault with documented recent activity.

- The pipeline alignment may cross the buried eastern extension of the Saddle Mountains fault which is inferred to be present beneath the anticline crossed by the route. During trenching for construction of this portion of the pipeline, the trench will be inspected for evidence of the fault or deformed soils by a qualified geologist.

- If necessary trench alterations as described above will be implemented.

Protection Measures Against Liquefaction

Mitigation measures will consider the degree of hazard, the soil and groundwater conditions at the site, the topography of the site relative to the pipe orientation, constructability issues, and other factors. Examples of accepted construction practices that would be considered to mitigate the impact due to liquefaction are provided below.

- **Buoyancy compensation:** In areas where liquefaction is possible but lateral spreading is not a significant concern, the pipeline can be weighted with river weights to achieve negative buoyancy. Alternatively, the pipeline can also be encased in concrete, achieving the same effect. Typically, enough weight is added to assure that the pipe will not float if the surrounding soil liquefies. The area the pipeline traverses across the Snoqualmie River Valley is a floodplain and the pipeline will be encased in concrete or weighted with river weights as a measure to prevent buoyancy of the pipeline should liquefaction occur.

- **Deep burial:** The pipeline can be installed in non-liquefiable deposits that underlie loose surficial deposits. Increased burial depth will isolate the pipeline from potential displacement of the susceptible overlying layers.

- **Above-grade support:** Where the depth of potential liquefaction exceeds the practical pipe burial depth, it may be feasible to lay the pipe on saddles supported by piles or piers designed to resist lateral loads. Typical pier designs consist of 24 to 36 inch diameter reinforced concrete piers with restraining saddles supporting the pipe. The piers would extend into non-liquefiable soils at depth and would have adequate capacity to resist lateral loads and allow liquefied soils to flow beneath the pipe.

- **Removal and replacement:** Liquefiable materials surrounding the pipe can be removed and replaced with compacted fill. The extent of replacement will be determined based on site conditions, but will generally extend several feet to each side of the alignment and down to non-liquefiable soils.

- **In-situ densification:** Potentially liquefiable soils can be densified in-place where the depth of the susceptible layer exceeds practical excavation depths. In-place densification methods include vibroreplacement (stone columns), heavy tamping, grouting, and other variations. The method, extent, and depth of in-place densification will depend on site topography and soil composition.

Protection Measures Against Volcanic Activity

Direct or indirect effects of volcanic activity from Cascade Range volcanoes are not anticipated to adversely impact the proposed pipeline, pump stations, and terminals. Therefore no specific protective measure are planned.

- In the event of a volcanic eruption, protective measures against ash fall would not be necessary during the operation of the pipeline. During the eruptions of Mount St. Helens, fuel deliveries to Portland on the existing OPL mainline in western Washington were not interrupted.

- As a good engineering practice, the proposed pump station facilities along the pipeline will be equipped with air filtration systems. In the event that ash fallout from a volcanic eruption reaches the pipeline facilities and begins to adversely impact operations, the pipeline system would be shut down until safe operating conditions return. If an eruption occurred during construction, a temporary shut-down would most likely be required to protect equipment and human health.

Protection Measures Against Avalanche and Landslides

The mitigation measures listed below have been selected based on the information available at the time of OPL's ASC. During design and construction, other alternatives may prove to be better choices depending on site-specific conditions. The final mitigation measures implemented will depend on many factors, including the scale of the hazard, the magnitude of the forces required to stabilize the site, ground conditions and constructability considerations. Alternative mitigation measures other than those identified below will be selected only if they provide an equal or greater level of protection to pipeline for the hazard. The following are brief descriptions of the proposed mitigation measures.

- **Avoidance:** Where possible, the pipeline alignment has been moved away from mass wasting locations identified as moderate and high hazards.

- **Reorientation of Pipeline Against Slope:** The pipeline can be oriented from parallel to perpendicular to the fall line (and any intermediate orientation) in either of these two situations:

  - Shallow (<10 feet) movement, either episodic (landslides) or continual (creep); or
  - Deep-seated (>10 feet) episodic movement.

- **Strain gauge on pipe:** Monitors induced compression and tension stresses caused by soil movement impacting the pipeline. Serves as an early warning indicator to implement to allow active mitigation measures to be implemented, e.g., closing block valves, trench excavation for stress relief.

- **Long-term monitoring:** Installation of instrumentation (e.g., inclinometers, extensometers) to measure ground displacement. Frequency of monitoring to be adjusted according to weather conditions, but will not be greater than one month. Instruments could be read manually or connected to an automated data acquisition system.

- **Drainage:** Diversion of surface and subsurface water. Example of options to improve drainage included; horizontal drains, dewatering wells, trench bedding of with free-

draining materials, and rerouting of surface drainage courses. Drainage can be a stand-alone option or used in conjunction with other slope stabilization methods.

- **Buttress:** Increase resistance to slope movement by installing a buttress at the toe of the slope (e.g., retaining wall, compacted earth, rip rap). Buttressing could be used alone or in conjunction with other slope stabilization methods.

- **Regrade:** Flattening slope grades to reduce driving forces tending to cause slope instability. Regrading can be used alone or in conjunction with other slope stabilization methods.

- **Increase dept of burial:** Where potential slope instability is possible to depths of 10 feet or less, increasing the pipe burial depth will place the pipeline below failure surface. The pipeline will be buried approximately five feet below the ground surface across these areas of concern. Slope instability affecting less than five feet in depth below the ground surface at the pipeline location will not have a significant impact on the pipe. Therefore, a key to identifying the relative hazard for the first type of slope movement. For the second case, evidence of previous deep-seated sliding would be the key to identifying this type of hazard.

SPILL PREVENTION

Release Prevention Methods

The following pipeline release prevention methods will be incorporated into the engineering design of the proposed Cross Cascade pipeline system.

- Check and gate valves to control back flow in the event of a release.

- Pressure relieving valves will be installed at appropriate locations to avoid pressure buildup.

- Regular maintenance will be conducted.

- All valves, pipes, and fittings will be maintained at a working pressure suitable to the design requirements of the system.

- Cathodic protection will be installed and maintained.

- Line markers will clearly define pipeline right-of-way crossings of roads, rivers and streams.

- Work by third parties along the right-of-way will be monitored.

- All of the pipeline will be subject to periodic (minimum of every 5 years) inspections via an internal inspection tool (smart pig).

Block valves will be located at pump stations and at crossings of large rivers or streams that have a large number of water withdrawals.

Spill Prevention, Control and Countermeasure (SPCC) Plan

- OPL will prepare a separate SPCC plan for the required facilities of the proposed Cross Cascade Pipeline. The SPCC plans will be for the proposed pump stations at Thrasher, North Bend, and Kittitas, including the storage facilities at Kittitas. As new pump stations are constructed (Stampede, Beverly-Burke, and Othello), the plan will be amended to cover those facilities. The plan will also be updated as new storage tanks are constructed at the proposed Kittitas Terminal. The plan will be submitted no later than 65 days prior to the operation of the proposed facilities.

- The pipeline will be a welded steel pipeline, operated at ambient temperatures, and protected from corrosion by an impressed current cathodic protection system and coating.

Continuous Monitoring

- OPL personnel will continuously (24 hours per day) monitor operational performance and integrity throughout pipeline operations and terminal transfers.

- Monitoring will be performed through visual inspections and analysis of pipeline operational conditions, such as line pressures, flow volumes, and pump and valve actuation.

- Tank levels and operation conditions at the Kittitas Terminal will also be continuously monitored remotely from the Renton Control Center and visually by facility personnel during normal operating hours.

- The Renton Control Center will have the capability of remotely controlling pumps and valves and monitoring the pressures and flow volumes along the entire length of the proposed pipeline.

- If abnormal operating conditions occur during pipeline operation, audible and visual alarms will activate, and an investigation will be initiated by system controllers to determine the source of the abnormal condition.

Kittitas Terminal Operating Conditions

The Kittitas Terminal will be equipped with both terminal lockout and shutdown devices and/or procedures that will result in a lockout or shutdown.

Terminal and delivery facility lockout will be activated when any one of the following conditions occur.

- Local initiation of the terminal lockout button from the local control panel or emergency lockout button from any pole position in the terminal yard. When the lockout or emergency lockout button is activated, the entire terminal complex will be locked out. Alarms at both the local control panel and the Renton operations control panel will be activated.

- High-high sump tank level. The terminal and delivery shutdown occurs when the sump high-high level monitor is activated. Alarms at both the local and Renton control centers are activated.

- Relief line flow will lockout the terminal and delivery shutdown occurs. Alarms are triggered at the local and Renton operations control panel.

- Devices will be installed to detect when ultraviolet radiation exceeds the maximum allowable for a specified time, indicating possible fire conditions. Alarms are activated at both the local and Renton operations control panels.

- Foam sprinkler systems will be installed that, when activated, also trigger alarm systems in both the local and Renton control panels. In addition, OPL will coordinate with the local fire departments (Kittitas and Ellensburg) to determine the appropriate alarm and notification systems for their needs.

- All storage tanks will be equipped with both a high-level monitor that activates delivery facility lockout and shutdown. The monitor/annunciator also activates alarms at the local and Renton control panels.

Supervisory Control and Data Acquisition (SCADA)

Detection and estimation of release volumes is achieved through the use of Supervisory Control and Data Acquisition (SCADA) software, field hardware, and the experience of the Renton Control Center Operations Controllers. The combination of hardware and software tools provides the operations controllers with significant detection capabilities.

A fundamental leak detection capability of SCADA that alerts operation controllers of possible problems is the over/short subsystem. The surveillance functions include over/short volume calculations based upon:

- Net volumes from metered injection and receiving points
- Net volumes calculated from tank level readings
- Net line segment inventory changes

The sensitivity of model compensated volume balance leak detection is influenced by a number of factors including the instrumentation, communications, and computer systems associated with the pipeline; the physical conditions present at the site of the event, and the manner in which the event develops. The instrumentation, communications, and computer system technology that will be employed for the new pipeline is designed to detect leaks of less than one percent (1%) of average pipeline flowrate. It is important to recognize that an integral component of the leak detection system is Olympic's operational monitoring program. This program includes over-flights of the route approximately every two weeks, periodic inspection of facilities by field personnel, and landowner education. These activities are designed to identify product losses which are below the threshold that is detectable through the technology.

Safety Devices

- The OPL operating system has safety devices installed to protect pipeline facilities and prevent injury to persons, property, and the environment.

- Generally, these alarms will require or result in shutdown of some portion of the pipeline system. In the event of a station lockout, field employees will be sent to investigate and correct the condition.

- The shutdown portion of the system will not be restarted until the designated field employee notifies the Renton Control Center Operations Controller that an abnormal condition does not exist and the system may resume operation.

Visual Monitoring

In addition to continuous monitoring of operating conditions via the Renton Control Center, visual inspections of the pipeline right-of-way will be performed on a frequent and consistent basis.

- Aerial visual inspection of the entire length of the pipeline is performed at a minimum of 26 times per year (Federal DOT minimum required). OPL policy is to schedule an aerial inspection once a week.

- Pipeline segments are also visually inspected via maintenance personnel during the normal course of work, and routine observations will be made by surface vehicles as they drive along rights-of-way. Abnormal conditions will be noted and responded to immediately.

- If abnormal conditions are noted by the Renton Control Center, field personnel are directed to the affected area(s) to visually assess the situation.

Reports From Outside Sources

Conditions which may indicate that a release has occurred, may be reported by noncompany personnel.

- The conditions will be responded to by facility personnel closest to the reported release.

- Signs will be posted on the perimeter fences of facilities (pump stations and block valves) with a 24-hour telephone number to call in the event of an emergency.

- The OPL 24-hour telephone number is also printed on right-of-way signs at highway and water crossings, on milepost markers, and along the right-of-way.

EARTH

Construction

Site-specific geotechnical engineering evaluations will be conducted prior to design of the facility to identify design methods to address the potential impacts presented above. In addition, the following mitigation measures will be included:

- All of the excavations in high hazard prone areas mapped as high hazard to erosion and/or mass wasting (based on mapping completed for the preparation of the application) will be monitored by a geologist or engineer during construction to verify proper excavation methods for the soils and/or rock encountered. Blasting of the bedrock will be conducted by experienced blasting personnel who will control overblasting.

- Dry unlined irrigation canals are proposed to be open trenched.

- Wet, unlined canals, depending on the flow volume, are proposed to be either jack-and-bored under, or the water will be diverted and the canal trenched. Wet, lined canals are proposed to be bored under. All repairs to irrigation canals will be done in accordance with the Reclamation District repair specifications.

- Activities at bored crossings will be restricted to the expanded right-of-way described in the application. The right-of-way will be re-vegetated and reclaimed as per provisions in the application and with stipulated agreements with intervening agencies.

- The placement of fill consisting of moisture-sensitive soils will be limited to the drier months between July and October. If the construction schedule requires backfilling during other periods, additional mitigation measures will be used. The fill placement will be monitored during construction by a geologist or engineer to verify proper compaction of the fill soils.

- The contractor will be allowed to work in wet weather provided that the contractor is able to demonstrate the capability of construction at the same level of quality control as during dry weather and as established by onsite inspection personnel. The contractor will need to demonstrate a safe work environment while subscribing to all provisions of the project specifications, the various stipulated agreements and the erosion control provisions in particular.

- The banks of streams will be protected after disturbance to limit post-installation erosion.

- Permanent slope stabilization measures and/or dewatering systems will be utilized as necessary during the pipeline installation to minimize slope instabilities. Two areas where these measures are likely are the south slopes of Cherry Creek and Tolt River crossings.

- The directional drilling operations will be monitored to minimize adverse impacts during the construction of the staging areas, as well as the drilling. An erosion control plan will be completed and implemented to minimize erosion.

- In steep, rock-walled slopes, protection such as rock nets and safety benches will be incorporated in the final design of the pipeline to protect workers, equipment, and the pipeline from damage or injury from rockfall. A construction plan will be completed and implemented to limit impacts.

- In the areas where saturated liquefiable soils have been identified, if the depth to non-liquefiable soils is not too great, over-excavation and replacement with non-liquefiable soils may be used as a mitigation measure.

- To mitigate potential seismic impact to the pipeline, the final design will incorporate measures to enable the pipeline to reasonably withstand anticipated ground motion.

Operation

- Potential geologic hazard areas will be further mapped as part of the "as built" survey and these areas will be visually inspected as part of the routine inspection program.

- A schedule of visual inspection will be instituted which will be used during increased precipitation or following abnormal seismic activity. These inspections will look for signs of incipient mass movement in those areas identified as potentially susceptible to such failures.

- Potential mitigation measures for mass movement include installation of the pipe with its longitudinal axis parallel to the direction of potential ground movement; anchoring the pipe to stable underlying rock; or installation of ground motion or pipe stress sensors, if feasible.

AIR

The mitigation measures for air emissions during operation are included within the designs of the pump stations, Kittitas Terminal and Pasco delivery facilities. There are no additional mitigation measures proposed for the Kittitas Terminal or for the pipeline operations concerning air emissions other than what is included in the design. Best Available Control Technology (BACT) will be employed to mitigate impacts to air quality. The Kittitas Terminal will comply with New Source Performance Standards (NSPS), including inspection and maintenance of the tank roofs, seals, and vents. Routine inspection and maintenance is included in the Operations and Maintenance Plans for the facility.

Truck loading operations will incorporate the following mitigation measures:

- The truck rack will have dry break couplings on the loading arms eliminating product spills and vapor loss when decoupling the arms from the trucks.

- The trucks will be submerged filled using bottom loading which also reduces vapor loss. A vapor recovery system will be employed during the loading operations as well.

- Trucks will be leak tested and vapor-tight, considerably reducing emissions which may be lost during loading and transit. Records will be maintained on site of all tanks and leak testing.

Mitigation measures for dust control during construction will consist of:

- Watering the right-of-way periodically as necessary.

- Applying gravel to access roads where traffic volume is high and where the road surface will need improvement.

- Curtailing construction activities when high winds are contributing to excessive dust.

- Reducing speed limits on the right-of-way during construction to 10 mph.

WATER

The primary means to minimize impacts during both construction and operation of the project is to follow BMPs as outlined in Section 2.10 of the ASC for surface water and erosion control, and to use the appropriate stream crossing construction trenching method as field conditions warrant (See Section 2.14 of the ASC, Construction Methodology).

Effective application of drainage and erosion control BMPs during construction, and appropriate construction methods will result in minimal impacts. The key mitigation strategy and BMPs that will insure minimal impacts are the following:

- Minimizing the amount of disturbance.
- Seasonal construction phasing, thus avoiding time periods when significant erosion can occur.
- Effective monitoring of BMPs during construction to detect problems before they become significant, especially at the most sensitive crossings, followed by appropriate actions to modify the BMPs if monitoring indicates that problems are developing.

The key design and construction features and post-construction BMPs and activities which will insure minimal impacts during operation include the following:

- Adequate pipeline burial depth and width at each crossing, considering the full active channel width and active downcutting of the bed in incised channels.
- Stream bank and bed stabilization after construction.
- Aggressive slope stabilization and re-vegetation after construction.
- Inclusion of block valves at spacings sufficient to prevent large petroleum products releases, placement of trench plugs in the pipeline trench on each bank of a crossing (to prevent leakage from entering a stream via the trench fill).
- Effective long-term monitoring of erosion conditions to prevent potential pipeline exposure.
- Effective corrosion protection at crossings (and in areas of shallow groundwater) to preserve the integrity of the pipeline.
- Effective long-term monitoring for leaks and spills to provide adequate lead time for prevention and cleanup actions.

Surface Water

The impacts of the pipeline system will affect approximately 78 wetlands and 293 watercourse crossings. The number of streams and rivers which are significantly impacted depends upon the aquatic resources within those watercourses, and in some instances, the location of the crossing on a particular watercourse. The following are mitigative measures designed to address the impacts of various activities at watercourse crossings.

Staging Areas

- Staging areas will be located at least 100' away from streambank where topographic conditions permit.
- The streambed preparation area will typically be 60' by 100' on both sides of the stream crossing.
- No hazardous materials, chemicals, fuels, and lubricating oils will be stored within the floodplain.
- All equipment will be refueled at least 100' from the streambank.

Spoil Placement and Control

- The upper 6 to 12" of topsoil will be removed and protected throughout construction with erosion control devices.
- Spoil flow, or runoff of spoil will be prevented from going off of right-of-way.
- All spoil material from water body crossings will be placed in the right-of-way at least 10' away from the ordinary high water line.
- The materials removed from the trench below the topsoil level may also be stockpiled in adjacent upland areas. However, it will not be placed on top of, or mixed with, the topsoil material previously removed.

Time Windows for Construction

- Construction of stream crossings will occur during low flow periods but prior to anadromous fish migration.

Watercourse Crossing Procedures

- At no time will heavy equipment be allowed directly into the stream or onto the riparian area immediately adjacent to the stream.
- Equipment crossings of sensitive perennial streams will be accomplished with the use of pads with culverts, clean rockfill and culverts, or a portable bridge.
- The crossing through the stream will be reduced to 30' wide or less.
- Stream crossings will be constructed as perpendicular to axis of stream channel as engineering and routing conditions permit.
- Before trench excavation begins, vegetation and topsoil in the riparian zone will be removed and stockpiled for later use.
- Material removed for trench construction will be stockpiled on the ground outside the sensitive area and contained within an earthen berm.
- Once the trench has been excavated, preconstructed lengths of pipe will be pulled through the stream ditch underneath the bypass pipe.
- If the stream width warrants it, concrete coated pipe will be installed to prevent the pipe from floating up through the surface after water is returned to the streambed.
- Clean gravel will be used for upper 1' of fill over backfill trench within stream channels.
- Downstream flow rates will be maintained at all times.
- For crossings of ecologically sensitive fish habitat, streams will be routed across a trench using a flume pipe or pump around system using the "dry ditch" technique.
- Instream construction in minor streams will be completed within 48 hours if possible.
- If blasting is required, fish will be captured and relocated to other appropriate stream areas prior to blasting activities.

Temporary Erosion and Sediment Control

- See Section 2.10 of the ASC, Surface-Water Runoff, for a listing of erosion and sediment control devices.
- Temporary erosion and sediment control devices will be inspected daily and repaired as needed.

- Sediment filter devices will be installed and maintained at all streambanks.

Bank Stabilization and Revegetation

- The streambank will be returned to original contour when possible.
- Revegetation will be performed immediately after construction using vegetation that quickly establishes and plant native plants such as willows and alder for long-term stabilization.
- Log deflectors will be used where practicable to create sediment deposition and allow the reestablishment of vegetation to stabilize banks.
- The use of rip-rap will be limited to areas where flow conditions preempt vegetative stabilization.

Operations

- All river crossings will be restored after construction and will have ongoing maintenance as required to prevent erosion.
- Frequent inspections of the pipeline by air will provide detection of any potential problems due to erosion or other construction activity in the area.
- Water crossings will be surveyed for bottom contours to ensure adequate soil depth over the pipeline is maintained.

Senior Water Rights

- If a spill should occur of sufficient quantity to impair downstream water use, Olympic Pipe Line will compensate for the impairment according to a plan developed in coordination with state and local authorities, and communities in each Water Resource Inventory Area (WRIA).

Runoff and Absorption Mitigation Measures

Minimizing impacts and mitigation for impacts to runoff and absorption resulting from the project construction and operation revolve around the following general BMP and mitigation strategies:

- Adequate drainage and erosion control during construction;
- Minimizing disturbance area;
- Avoiding construction during periods of high precipitation (seasonal construction phasing);
- Adequate re-vegetation and slope stabilization after construction; and
- Effective monitoring of BMPs during construction and spill monitoring during operation.

Floods and Floodplains Mitigation Measures

- To minimize potential impacts to the pipeline from flooding, all pipeline facilities and above ground valves will be located outside of floodplain boundaries.
- The pipeline will be buried below maximum scour depth across the full width of the floodplains, and will be encased in concrete pipe to protect against scour and floatation.

Groundwater

The project incorporates measures to avoid or minimize harm to groundwater. Erosion control measures will be used in all areas where soils are exposed to the elements during project construction requiring drainage basins or settling ponds which could become a pathway to groundwater. The measures to minimize potential groundwater contamination will include one or more of the following:

- Clearing and grading will be limited to the minimum necessary for the pipeline construction.
- Surface water will be diverted from all excavations using temporary and permanent runoff diversion structures.
- Sediment retention ponds will be constructed as deemed necessary to prevent siltation of surface water drainages.
- Surface protection techniques such as mulching will be done as necessary.
- Disturbed soils will be graded and seeded after the pipeline construction has been completed.

- Until vegetation is established, settling basins will be maintained to help remove sediments from stormwater runoff before it discharges into natural watercourses.

- To prevent localized impacts to groundwater quality adjacent to and downgradient of excavation, minor spills will be cleaned up by construction crews as part of their operating guidelines.

- In areas where low permeability soils occur at or near the surface, the backfill will be compacted to match the native overlying soils, and if necessary, the bottom of the trench will be lined with a low permeability material.

- The pipeline will utilize cathodic coating and cathodic protection to prevent corrosion. The entire pipeline will be inspected for corrosion on a regular (annual) basis and the most sensitive areas will be inspected more frequently.

- To prevent accidental spills at pump stations from reaching surface or groundwater, OPL provides leak containment at each pump station site. Valves and pump stations will be kept to a minimum in the most sensitive pipeline segments.

- Deeper burials, concrete coating, thicker-walled pipes and cathodic protection to prevent corrosion are measures used to prevent damage to the pipeline.

- To protect existing and senior water right holders, OPL will develop, as part of the project implementation, a compensation plan worked out with the communities, state and local agencies as a WRIA basis to be implemented in the event of an accidental release.

- There will be no block valves located on the pipeline over sole source aquifers except at the Thrasher Pump Station. The pump station will be electronically equipped to detect leaks and leak containment will be provided.

- In sensitive areas, trench lining will be employed that will prevent petroleum products from escaping the trench, and will direct the petroleum products toward a lower sensitivity area for capture and clean-up.

- During trenching, there is the possibility of encountering historically contaminated soil as well as buried structures such as wells and underground storage tanks. In these circumstances, proper disposal procedures will be implemented, and the piping will be rerouted to avoid abandoned wells or contaminated soils discovered during the construction process.

- In areas where groundwater conditions could necessitate dewatering in large volumes, rerouting of the pipeline would be considered.

PLANTS AND ANIMALS

Upland Vegetation

Mitigation strategies, in order of priority, are: (1) avoidance; (2) minimization; (3) restoration; and (4) compensation.

Avoidance

Avoidance of impacts to upland plant communities has been accomplished in a number of ways. Route alignment and engineering design have resulted in avoiding vegetation impacts along portions of the proposed corridor, most notably in forested plant communities.

Along some segments of the route that are forested, there are logging roads and rail-trails that can be used as a construction corridor. In the forested areas where existing roads and trails are available, specialized construction equipment will be used so that the adjacent forested vegetation will not be cleared (although some overhanging branches may need to be cleared to provide sufficient overhead work space). Given the amount of the route that is forested, this construction technique will significantly reduce the impacts to forested areas.

Construction equipment will use existing access roads to access the construction corridor. Therefore, vegetation will not be removed to access the work areas. By not constructing any new access roads, additional vegetation impacts have been avoided.

In some cases, impacts to priority vegetation habitats (such as oak woodlands and old-growth forest) has been avoided by carefully routing the pipeline around these plant communities.

Where avoidance of upland impacts is not feasible, the following mitigation measures will be used.

Minimization

Impact minimization includes measures taken to reduce the amount of vegetation affected by the construction of the pipeline as well as measures taken to prevent invasive plant species from becoming established in cleared areas. Impacts will be minimized by utilizing the narrowest construction corridor feasible. The construction corridor will be a maximum of 60' in width (and only 30' wide in stream and wetland buffers). To ensure that vegetation beyond the construction corridor is not unnecessarily removed or crushed by equipment, the pipeline alignment and construction corridor boundaries will be clearly staked and marked to minimize equipment impacts. Temporary fencing will be installed where needed to prevent unanticipated vegetation impacts. Stumps of trees and roots of shrubs will only be removed where absolutely necessary (e.g., where excavation and grading will occur).

Specific measures will be employed to minimize the invasion and spread of undesirable plant species. They include:

- Straw bales will be used instead of hay bales for erosion control to limit the number of weed seeds introduced to disturbed areas.

- Disturbed areas will be replanted with native species after the topsoil has been replaced.

- Trees and shrubs will be replanted in all appropriate disturbed areas outside the maintained corridor to shade out undesirable grasses and weeds.

- Recommendations from the State and County Noxious Weed Control Boards will be used.

In areas that are dominated by non-native and/or invasive species, those species have the potential to return once construction is complete. Measures implemented to reduce the potential for invasive and/or non-native species to become established will focus primarily on those areas that are composed of primarily native vegetation.

Petroleum products spill impacts will be minimized by employing the Spill Prevention Plan prepared for this project.

Recommendations from the County Noxious Weed Control Boards that will be implemented to minimize the spread of noxious weeds include re-vegetating the construction corridor with certified weed-free seeds, pressure washing construction equipment, and working with board representatives to control spread of weeds.

Restoration

Restoration will begin when construction is complete.

- Final grading will include construction of diversion levees across slopes and chiseling or discing compacted soils.

- Areas dominated by forested and scrub-shrub plant communities will be restored within the portion of the construction corridor not maintained as right-of-way.

- All vegetation planted or used in seed mixes will be native to the area. Shrub-steppe habitats will be restored along the entire width of the construction corridor with a mix of shrub and grass seeds that are native to the area. Areas currently composed of herbaceous vegetation will be restored with a seed mix native to the area.

- Cropland and hay/pasture plant communities will be restored.

- Plants will be installed in the ground and seed mixes spread in late summer before the rainy season begins.

Compensation

- Forested areas that will be maintained as part of the permanent right-of-way will be converted to shrub and/or herbaceous plant communities. This will, in part, compensate for the loss of forested areas.

- The permanent loss of existing trees and snags in forested areas will be mitigated by planting trees and placing snags in onsite areas.

- Snags and downed logs will be placed in suitable upland areas, including wetland and stream buffers where they will increase habitat value.

- No offsite compensation is proposed.

Monitoring

- A five-year monitoring plan for upland vegetation, including contingency plans, will be developed and implemented. Parameters to be monitored will include the success of replanted vegetation, types and percentage cover of invasive species, damage to remaining vegetation along the corridor, such as blowdown or erosion of topsoil, and unanticipated impacts.

Wetlands

For each wetland impacted, specific mitigation measures will be evaluated and developed based on the functions and values of that wetland. These mitigation measures will follow the prioritization of avoidance, minimization, restoration, and compensation described above under the upland vegetation section.

Avoidance

Selection criteria to identify the proposed route included utilization of existing roads, trails, and transmission line corridors. As with other critical habitat areas, such as streams and oak woodlands, wetlands will be avoided where possible along the pipeline route. In particular, high value wetlands that are difficult to replicate will be avoided wherever practicable. Nevertheless, not all wetlands can be avoided, and a total of 17 acres of wetlands will be directly impacted by trenching or open cutting.

Other than the construction right-of-way, the only access roads which will be used in wetlands are those existing roads that can be used with no modification and no impact on the wetland. All construction equipment will be refueled at least 100' from water bodies or wetland boundaries. All equipment will be cleaned and inspected prior to entering a wetland. Equipment leaking oil or other fluids will not be allowed to enter a wetland.

Following are the wetland mitigation strategies that will be employed if avoidance is not feasible.

Minimization

Access, Staging, and Ancillary Areas

- Wetland boundaries in the construction corridor will be staked and flagged.

- Where wetlands must be crossed, the pipeline will be routed through less sensitive portions of the wetland if it is feasible.

- Pipeline construction impacts to wetlands will be minimized by using the narrowest possible corridor (30') and by constructing during a time of year when the resources (i.e., nesting or migrating waterfowl, water quality sensitive fish) are either not present or less vulnerable.

- The only access roads, other than the construction right-of-way, which will be used in wetlands are those existing roads that can be used with no modification and no impact on the wetland.

- All construction equipment will be refueled at least 100' from water bodies or wetland boundaries.

- All equipment will be cleaned and inspected prior to entering a wetland. Equipment leaking oil or other fluids will not be allowed to enter a wetland.

Spoil Pile Placement and Control

- The upper 6 to 12" of topsoil will be removed and protected throughout construction. This material may be stockpiled in adjacent upland areas.

- All spoil material from water body crossings must be placed in the right-of-way at least 10' away from the ordinary high water line. At a minimum, all spoil shall be contained within sediment filter devices.

- The materials removed from the trench below the topsoil level may also be stockpiled in adjacent upland areas. However, it will not be placed on top of, or mixed with, the topsoil material previously removed.

- Along with other temporary erosion and sedimentation controls, filter fencing and straw bales will be used during construction to minimize sedimentation in wetlands and to deter construction equipment operators from venturing further than absolutely necessary into sensitive areas.

General Construction Procedures

- All activities within the wetland will be kept to the minimum disturbance area possible.

- Construction techniques that minimize the compaction and mixing of wetland soils will be utilized.

- In wetlands and riparian areas, vegetation that must be removed will be cut at ground level, leaving existing root systems intact. The pulling of tree stumps and grading activities will be limited to those that would directly interfere with trenching, pipe installation and backfill.

- Trench plugs will be used as necessary to prevent diversion of water into upland portions of the pipeline trench.

- Grading will not take place within the boundaries of any wetland, and disturbance will be kept to the minimum necessary to safely construct the pipeline.

- Pipe sufficient to cross the wetland will be welded on the right-of-way and radiographed before being carried or pulled into the wetland and lowered into the trench. In long wetland stretches, it may be more feasible to weld up several joints of pipe, carry them into the trench leaving one end at the welding location, weld on additional lengths, pull them into the trench, and repeat this process until the entire wetland length has been crossed.

- If standing water or saturated soils are present, low ground weight construction equipment will be used, or construction will be done using prefabricated equipment mats.

- In the event that matting is necessary, all construction activities will be carried out from the matting. Equipment will not be allowed in the wetland off the mats, at any time. The mats will be inspected prior to placing in the wetland and mats with foreign material will not be used.

- Once the pipe has been laid in the trench, the subsoil will be replaced, followed by the topsoil. Excess material will be spread on the right-of-way outside the wetland boundaries.

Restoration

Many of the wetlands crossed by the proposed pipeline can be restored or partially restored in terms of acreage, functions, and values. Restoration of wetland hydrology is essential to the maintenance of wetland functions and values.

- Where trenching occurs through open water, aquatic bed, emergent, and scrub-shrub wetlands, soils and vegetation will be replaced.

- Where trenching through a wetland may alter the hydroperiod (i.e., excavating through a layer of till, or altering the topography, soil or sub-basin which supports wetland hydrology), soil, subsoil and/or topographic conditions will be recreated as nearly as possible to restore the existing wetland hydrology.

- Restoration of wetland, buffer, and riparian vegetation presently vegetated with native species is considered successful if the native herbaceous and/or woody cover comprises at least 80 percent of the total cover, and native species diversity is at least 50 percent of the diversity originally found in the wetlands. If revegetation is not successful at the end of the 5-year post-construction monitoring period, the applicant will (in consultation with a professional wetlands ecologist, EFSEC, WDFW, and DOE) develop and implement a plan to actively revegetate the wetland with native wetland herbaceous and woody plant species.

Compensation

Impacts to water quality and disruption of wildlife habitat during construction will be, for the most part, temporary in nature. Removal of forested wetland and buffer vegetation will have long term impacts, as will the permanent loss of any other wetland functions and values.

- Compensation for permanent impacts to wetland native plant communities and fish and wildlife habitat values will be negotiated with landowners and natural resource agencies.

- Specific mitigation plans, including monitoring, will be developed for each wetland or buffer loss to be compensated, with the goal of no net loss of wetland acreage, values and functions.

For wetlands that are disturbed but not lost, the following shall apply:

- **Forested wetlands.** Disturbance impacts to forested wetlands will be mitigated by both: restoration of the disturbed area to either forested wetland or scrub/shrub wetland; and enhancement of disturbed emergent herbaceous wetland to forested wetland in an amount equal to twice the disturbed area.

- **Scrub/shrub wetlands.** Disturbance impacts to scrub/shrub wetlands will be mitigated by both: restoration of the disturbed area to scrub/shrub wetland; and enhancement of

disturbed emergent wetland to scrub/shrub wetland in an amount equal to the disturbed area.

- **Emergent wetlands.** Disturbance impacts to emergent herbaceous wetlands will be mitigated by restoration of the disturbed areas to native emergent herbaceous wetland and enhancement of disturbed wetland in an amount equal to one-half the disturbed area.

- For those restoration, creation or enhancement areas that do not meet the success standards provided above after 5 years, additional replacement will be provided as follows: an amount of forested wetland equal to the unsuccessful portion of the restored forested wetland areas; and an amount of scrub/shrub or emergent wetland equal to the unsuccessful portion of the mitigation scrub/shrub or emergent wetland areas.

- Wetland restoration, creation, and enhancement will be designed to meet the goal of no net loss of wetland acreage and functions. In-kind replacement of functions and values will be preferred over out-of-kind replacement.

Monitoring

- A five-year post-construction monitoring plan will be developed and implemented to assess mitigation success or failure.

- Wetlands and other sensitive habitats will be monitored during construction to provide oversight to ensure the implementation of Best Management Practices and for onsite adjustments to construction practices.

- Restoration of wetland, buffer, and riparian vegetation presently vegetated with native species is considered successful if the native herbaceous and/or woody cover is at least 80 percent of the total cover, and native species diversity is at least 50 percent of the diversity originally found in the wetlands. If revegetation is not successful at the end of the 5 year post-construction monitoring period, the applicant will develop and implement (in consultation with a professional wetlands ecologist, EFSEC, WDFW and WDOE) a plan to actively revegetate the wetland with native wetland herbaceous and woody plant species.

Right-of-Way Maintenance

- Herbicides and pesticides will not be used.

- No management of vegetation will occur over the right-of-way in wetlands, wetland buffers, and riparian areas.

Wildlife

Mitigation measures include route changes and timing restrictions to avoid or minimize most effects along the route. Route changes were made to avoid priority habitats and special status species nesting or foraging areas. In areas where the project location could not be rerouted to avoid sensitive habitat or species, restrictions on timing of construction will be implemented where appropriate.

Impacts can be minimized for four key reasons:

- **Underground Location:** As the pipeline will be located underground, impacts on most land uses will be temporary.
- **Short Construction Period:** A pipeline is constructed in sections, thereby minimizing the time during which any particular area is under construction. For the most sensitive sections along the pipeline route, such as stream crossings, it is expected that construction will be completed within 48 hours. The length of time construction activities will take place in any given location will depend on the location, topography, soils, etc. West of Snoqualmie Pass, construction is expected to move approximately 1.5 to 2.3 miles per day while east of the pass it is expected to move approximately 1.9 to 2.7 miles per day. In the pass area and narrow sections of the route, such as along the JWPT or in Bonneville Power Administration (BPA) corridors, construction time will be approximately 0.3 to 0.5 mile per day.
- **Sensitive Areas Avoided:** The proposed pipeline route has been adjusted to take into consideration sensitive areas and to avoid them as much as possible. In its 231-mile length, over 99 percent of the corridor has been routed to avoid wetlands. The 17.07 acres that cannot be avoided will be restored or replaced. In addition, by placing the pipeline in existing right-of-way corridors, pipeline impacts are generally confined to areas that already have been disturbed.
- **Rivers, Streams, and Canals:** The proposed pipeline will cross 293 waterways, most of which are small streams, many of them intermittent. Wherever practicable, existing bridges will be used to cross wetlands and streams.

Preconstruction Mitigation

Mitigation measures applied prior to construction activities include measures intended to lessen impacts to species and habitat in the project area. Specific mitigation measures were formulated for vegetation and wildlife species, although many of these measures apply to both species and habitats. Mitigation measures developed for certain special status species or priority habitats are covered in ASC Section 3.4.5.2.

Preconstruction mitigation measures include:

- Consolidated the pipeline route to a single corridor along roads, railroads, and in existing rights-of-way to lessen impact from habitat fragmentation.

- New corridors were located along the periphery of forested areas whenever possible to lessen impacts to interior forest species and reduce impacts from edge effects.

- New corridors through forested areas will be restricted to 30' wide or less in the Alice Creek and Humpback Creek areas.

- The new corridor from Tinkham Road to the upper trail road near the Annette Lake Trailhead area will be curved to limit straight line-of-sight.

- State and federal wildlife agencies will be contacted periodically for possible additions of any endangered, threatened, or sensitive wildlife species, or priority habitats of statewide significance in the vicinity of the proposed project. If any are identified, coordination for any possible mitigation measures will occur with the appropriate agency.

Construction Mitigation

Construction activities will generally occur from June to October in critical wildlife areas. More specific timing restrictions will occur along the route where any special status species occur within the project area.

Mitigation measures to further reduce impacts will include the following:

- Full-time Environmental Inspector: In order to minimize impacts during construction, and to ensure that environmental protection is given a high priority, OPL will have a full-time environmental compliance coordinator during project construction. This coordinator will oversee qualified personnel working with construction crews to ensure environmental "best management practices" are carried out.

- Directional drilling will be used for crossing the Columbia River. Directional drilling is a method by which the pipeline is buried far beneath the river bottom. By using this method, neither the drill, nor the pipe itself, comes into contact with the river water.

- Other major river crossings will use an open-cut dry method which diverts the water flow in sections of the river for placement of pipe sections. This method can be accomplished in a very short period of time and eliminates the need for a large drilling equipment staging area.

- Confining Pipeline to Existing Corridors Minimizes Impact on Wildlife and Plants: The pipeline will use existing right-of-way corridors whenever possible. These corridors already have experienced significant alterations to vegetation and habitat. Edge and

corridor habitat have been created over the years, meaning that wildlife have adjusted to altered habitat conditions.

- Any habitat disruption will occur on a temporary basis during construction. Concentrated construction activity will take place for up to a two-week period in any given location. Disturbed areas will be restored.

- Construction of the pipeline in some limited areas will require the minimal cutting of trees. However, no old-growth trees have been identified in areas needing clearing. New rights-of-way will be created in areas where the proposed route must cross from one existing right-of-way to another. It will also be created where power lines in the existing right-of-way are strung from one slope to another, where shrub vegetation below the power line is currently re-established.

- Following construction, a 30' wide corridor is normally desired for long-term right-of-way maintenance. Thirty feet of the construction easement will be restored and revegetated with native plant species favorable to wildlife immediately following construction, consistent with a site-specific vegetation plan and landowners agreements, as appropriate.

- No access roads will be constructed through sensitive wetland areas and there will be no long-term maintenance right-of-way corridor through wetlands, wetland buffers, and riparian areas, with the exception of limited removal of trees in the wetland buffer.

- Erosion and Sediment Control: Construction contractors will implement an erosion and sediment control plan to include Best Management Practices. These plans and practices will minimize or eliminate potential impacts such as water quality degradation through sedimentation, erosion, and removal of vegetation, and effects on fisheries and aquatic resources.

- Little or No Long-term Noise Impacts: Temporary increases in noise will result from construction of the pipeline. However, most construction will be limited to daytime hours and most areas will experience no more than two weeks of construction activity at any given time.

- Restrictions on blasting will coincide with general timing restrictions for construction.

Noise from operation of the pipeline will be minor. The equipment at the Thrasher, North Bend and Stampede pump stations will be enclosed in buildings to minimize noise. The Kittitas Terminal is adjacent to 1-90, where noise levels are already high due to traffic. There are gasoline service stations in the immediate vicinity, but no residences.

- Native vegetation will be retained as much as possible in the impact area to preserve wildlife habitat. Shrub habitat will be maintained at low to medium vegetation heights in the rights-of-way buffers.

- The normal corridor needed during construction will be 60' wide. When a new right-of-way is created in sensitive areas, special construction techniques will be used to restrict it to the smallest area possible.

- In upland forested and riparian areas where new corridors are cut through forest, downed logs will be moved and replaced after construction if the logs and debris are substantial enough to allow replacement.

Coordination

- The U.S. Fish and Wildlife Service will be contracted prior to implementation of the project to update the list of endangered, threatened, and candidate species. If there are any new species listed, coordinate any possible mitigation measures with the appropriate agency.

- In consultation with state and federal wildlife agencies, pipeline construction will be scheduled to avoid critical periods for wildlife, such as bald eagle nesting periods.

- The Washington Department of Fish and Wildlife will be contacted prior to construction for updated information from the Natural Heritage Data Systems.

Fisheries and Aquatic Resources

Potential impacts to aquatic resources would be limited to the construction phase of the project. As such, the following mitigation measures pertain to construction. Because only selected trees will be removed from riparian areas, no other mitigation measures are proposed.

General Construction Procedures

- The WDFW will be notified at least 48 hours prior to the commencement of pipe installation activities or blasting within each water body.

Erosion Control

Site specific biotechnical methods of erosion control will be implemented at each waterway crossing. These erosion control methods will include:

- Construction of stream crossings will be limited, to the extent feasible, to the low flow period, which on sensitive crossings will occur between approximately June 15 and September 15, to minimize sedimentation and turbidity induced by high water flow.

- Erosion control measures will be used while constructing pipeline trenches and staging areas, particularly erosion that could lead to increased sediment loads or turbidity in nearby waterbodies. The specific methods used will depend on site conditions such as slope, soil type, and downstream receptors.

- Only straw certified as weed free will be used for mulch and site-specific biotechnical methods of erosion control will be used wherever appropriate. Disturbance of the soil and vegetation will be minimized.

- Vegetative components, alone or in combination with structural and/or mechanical components will be used to stabilize soil. The use of rip-rap to stabilize streambanks will be kept to a minimum and only used in site-specific situations where biotechnical methods of erosion control are not effective. After stabilizing soils with mulch or biotechnical methods of soil and slope stabilization, native vegetation will be planted in denuded areas. Appropriate native perennial plants with strong root structures appropriate for stabilizing streambanks will be selected for this purpose.

- Temporary and permanent runoff diversion structures will be utilized after careful placement planning to minimize runoff to denuded slopes or critical areas. Prompt grading, mulching, armoring, and revegetation will be used to minimize erosion. Sediment retention ponds will be used where sediment-laden runoff is greater than the capacity that can be controlled by more traditional means (i.e., straw bales and silt fences). Sediment retention devices will be used to filter water pumped from the pipeline trench.

- Slope steepness and slope length will be minimized through the construction of benches, terraces, contour furrows, or diversion ditches.

- Stable road fill will be used to minimize erosion.

- Crossing construction sites will be frequently monitored and inspected to insure that problems will be corrected promptly.

Refueling of Equipment

- All construction equipment will be refueled at least 100 feet from water bodies.

- Equipment refueling or repair will not be allowed in or near the floodplain without adequate provisions to prevent the escape of petroleum products.

- Storing hazardous materials, chemicals, fuels, and lubricating oils, activities will be performed outside the floodplain (at least 100 feet from bank).

- Waste lubricants and solids will be removed from construction sites and be disposed of using Department of Ecology and EPA-approved procedures.

Stream Crossings

- The timing of all construction will consider the migrational periods and rearing conditions of the salmonids. The construction windows established by WDFW for each county, or special project stream, will be followed.
- Where feasible, the pipeline will be attached to existing bridges at crossing sites to avoid impacts.
- The use of rip-rap will be minimized to areas where flow conditions preempt vegetative stabilization.
- EFSEC and WDFW will be notified at least 48 hours prior to proposed construction activities within streambeds.
- Crossings will be constructed perpendicular to the axis of the stream channel as engineering and routing conditions permit.
- Downstream flow rates will be maintained at all times.
- Equipment pads, clean rockfill and culverts, or a portable bridge will be used for equipment crossing sensitive perennial streams.
- Instream construction in minor streams will be completed within 24 hours.
- Sediment filter devices will be installed and maintained at all streambanks. The devices will be inspected on a daily basis and repaired as needed.
- Resident fish will be removed from stream crossing areas when blasting is necessary.
- Where possible, existing culverts will not be disturbed. The pipeline will be placed in fill above existing culverts to prevent construction impacts. Undersized culverts could be blocked by debris flows during winter storms, causing extensive erosion, sediment release into the water channel, and possible damage to the pipeline. Undersized culverts represent a pre-existing risk of sediment release into stream channels. As such, undersized culverts that are identified will be replaced as a pipeline construction mitigation measure.
- Where pre-existing blockages to migration of existing fish populations occur, modifications to the culverts may be made as a mitigation measure.

Hydrostatic Testing

- The entire pipeline will be hydrostatically tested in accordance with DOT regulations and in compliance with the stipulations of EFSEC regulations regarding water withdrawal and

discharge. Pipe installed in rivers will be hydrostatically tested prior to installation. If leaks are detected, they will be repaired or the pipeline section replaced and the section retested.

- All welds to be installed under water bodies or wetlands will receive a 100 percent radiographic inspection.

- At least thirty (30) days prior to use, EFSEC will be provided with a list of specific locations for withdrawals and discharge of hydrostatic test water.

- EFSEC will be notified of the intent to begin using specific sources at least 48 hours prior to testing.

- The intake hose for the hydrostatic test water will be screened (1/8" mesh) to prevent entrainment of fish. The maximum approach velocity will not exceed 12 cm per second.

- Adequate flow rates will be maintained at all times to protect aquatic life and to provide for all other water body uses, including downstream withdrawals.

- When hydrostatic testing is complete, the test water will be analyzed and treated if necessary to make it suitable for discharge in compliance with the water withdrawal and discharge permits issued for the project.

- The water will be detained in ponds or holding areas and discharged to the ground or through filtering media before it enters any watercourse. Erosion protection measures will be incorporated into the water discharge procedures. Final discharge plans will be developed in consultation with EFSEC.

- The water discharge rate will be regulated and energy dissipation devices will be used in order to prevent erosion of upland areas, stream bottom scour, suspension of sediments, or excessive stream flow.

Clearing, Restoration, Stabilization, and Revegetation

- All staging areas, access roads, and temporary access roads will be located at least 100 feet back from the streambank where topographic conditions permit to reduce loss of riparian vegetation and limit the probability that these additional cleared areas will erode.

- Clearing for staging areas for pipeline construction will be confined to the minimum area necessary, and generally are confined to the construction corridor or existing cleared areas away from streams.

- All spoil material from water body crossings will be placed in the right-of-way at least 10 feet away from the riparian zone, or in other EFSEC-approved trenched material storage areas. All sediment will be contained within sediment filter devices.

- Disposal sites that contain cleared slash and overburden will be located in upland areas away from water bodies and will entail the use of runoff control structures.

- Streambanks will be stabilized prior to and after construction by replanting riparian vegetation.

- Clean gravel will be used for the upper one foot of fill over trenches (excavations) in streams.

- Revegetation will be performed immediately after construction using vegetation that is quickly established and native trees for long-term stabilization.

- Black cottonwood (*Populus trichocarpa*) will be planted in locations along the Yakima River, selected with the advice of WDFW biologists, to increase the shade and cover of the middle reaches of this river.

- In rangeland, where heavy grazing by livestock has denuded riparian vegetation and destablized streambanks and channels, revegetated areas will be protected by fencing to permit quick regrowth. Where permitted by landowners, sensitive areas of streambank vegetation can be fenced to restrict livestock access and encourage the regrowth of riparian areas in mitigation for the removal of riparian shrubs and trees at pipeline crossings.

- Log deflectors will be used that create sediment deposition and vegetation establishment to stabilize banks where possible.

Priority Species

Mitigation measures proposed for priority plant species and plant communities are:

- Avoid or minimize direct impacts to known areas of occurrence or habitats that may support these species, including soils compaction.

- Implement fire prevention and abatement procedures during construction and maintenance of the pipeline.

- Implement and monitor a plan to control invasive species that may out-compete the vegetation of concern.

ENERGY

The proposed project is not expected to have a significant impact on energy resources and thus no mitigation measures are proposed.

ENVIRONMENTAL HEALTH

Noise

Construction

Mitigation measures during construction operations will include the following:

- Construction will be generally limited to daylight hours.
- All construction equipment shall have sound control devices no less effective than those provided on the original equipment.
- No equipment shall have an unmuffled exhaust system.
- If needed, temporary sound barriers will be used to minimize construction noise if equipment mufflers are not adequate.

Operation

OPL will ensure that noise impacts of the Kittitas Terminal and pump stations remain low. Electrically operated equipment will be utilized at each facility, limiting noise levels substantially.

- OPL proposes to enclose the pump stations that require noise level reductions.
- Ambient noise measurements may be recorded to ensure noise standards will not be exceeded at the pump station locations. If noise levels are found to exceed the standards, appropriate noise reduction methods will be employed.
- At the Kittitas Terminal a simple noise barrier may need to be placed along the west fenceline to mitigate impacts due to the truck loading rack.
- Pump stations will be strategically placed within the property to eliminate noise exceedances at the property border.

Mitigation of Risk

- The risk of an explosion at the storage facility will be mitigated by designing, constructing, and operating the facility as required in the latest versions of the applicable codes, regulations, and consensus standards.
- Construction of the storage tanks will follow API recommendations that include venting near the top of the tanks to prevent an accumulation of fuel-air vapors that are required for an explosion to occur.
- An internal floating roof within the fixed roof tank contains a seal to minimize vapors from escaping into the open space above the floating cover and the fixed roof.
- The availability of an ignition source to detonate an accumulated fuel-air mixture will be limited to further reduce the probability of an explosion occurring.
- The facility will be operated by qualified personnel using written procedures. Procedures will provide clear instructions for safely conducting activities involved in all operations of the distribution facility including emergency situations.
- Before being involved in operating the distribution facility, employees will be presented with a facility operations plan, and will receive training regarding the operating procedures and other requirements of safe operation of the facility. In addition, employees will receive annual refresher training, which will include testing of their understanding of the procedures. Training and testing records will be maintained.
- A hazardous materials emergency response program will be implemented for the facility. See ASC Section 2.9 Spill Prevention and Control, and Section 7.2 Emergency Plans.
- The pipeline location will be clearly marked at fencelines and road crossings to minimize risk of third-party damage.

LAND AND SHORELINE USE

Land Use

The following mitigation measures will be implemented to minimize project-related impacts on existing land uses.

Construction

- Construction generally will be limited to daytime hours.
- All construction equipment will operate with standard muffler systems.
- Construction areas will be watered as needed to prevent fugitive dust spreading to adjacent land uses.
- Construction on narrow rights-of-way and at or near recreational trails and sites will be continuously controlled to ensure, to the greatest degree feasible, safe and continuous access to recreation areas.

Operation

- A vegetative buffer zone will be placed along the boundaries of the Kittitas Terminal to reduce noise impacts to nearby receptors.
- Pump stations will be placed adequate distances from potential noise receptors, or enclosed, to ensure that noise levels remain low.

Visual

Route Planning and Construction

Construction of the pipeline will generally impose temporary visual impacts. Actions already considered to lower impacts to visual resources include:

- Minimize tree cutting and vegetation clearing by routing the pipeline within road and trail right-of-ways, and following existing utility corridors where possible (e.g. BPA). Trail and road users will be impacted, but the impacts will be temporary.
- Stockpile topsoil separately from subsoils and replace over the pipeline after installation to speed regeneration of vegetation using existing seed stock in the soil.

Operation

- Permanent impacts in locations where the pipeline cuts through forested areas can be reduced by creating irregular edges to the corridor to avoid the appearance of a linear swath.

- In specific areas of high visibility like the slope cuts identified in ASC Section 5.1.4.3 of the ASC, adjacent land outside the corridor right-of-way could be acquired for selective cutting to create a larger area for visual patterning.

- Visual impacts will be reduced by planting new, or additional, vegetation around the periphery of the facilities to provide visual screening. A mixture of trees and large shrubs (evergreen, deciduous, etc.) will be used to provide variety of sizes, colors, and textures throughout the year. Planting patterns will be irregular with areas of higher density to avoid a "hedge-row" appearance.

Light and Glare

Light and glare impacts are expected to be low. Therefore, no mitigation is proposed for light and glare.

Recreation

- During construction, all attempts will be made to keep impacts to recreation facilities to a minimum. Through access on recreation trails will be maintained as much as practicable.

Cultural Resources

Additional study will be conducted to determine National Register eligibility of three sites identified within the project corridor. Furthermore, additional survey work is necessary on approximately 1.9 percent of the route where access was not obtained to provide a complete inventory of the corridor. As a result, site-specific mitigation measures for unsurveyed areas cannot be recommended at this time. The following general recommendations, however, can be made.

- Because pipeline construction could have an impact upon previously unknown cultural resources, construction within archaeologically sensitive areas will be monitored to ensure proper identification, evaluation, and if necessary, mitigation of discovery situations.

- Monitoring will be directed by a qualified archaeologist.

- If cultural resources are identified during construction, the archaeologist will request that construction be halted in the vicinity of the find until necessary steps for evaluation of the significance of the find can be taken and appropriate mitigation actions can be identified, if warranted. The Washington State Office of Archaeology and Historic Preservation (OAHP) will also be contacted at this time.

- In accordance with RCW 27.44, Indian Graves and Records, if a discovered site contains Native American human remains, the monitor will notify the appropriate Tribe and discuss treatment measures with Tribal representatives and the OAHP.

- If the National Register significance of a discovered site cannot be evaluated using available data, an evaluation plan will be developed. Such a plan might include surface collection, archaeological excavation, and artifact analysis.

- If a discovered site is found eligible for listing in the National Register of Historic Places, avoidance will be recommended as mitigation. This is particularly important in the case of Native American human remains. Avoidance may also be the only feasible option for mitigating adverse effects to traditional cultural properties and religious sites. If avoidance is not feasible, a resource plan will be developed for the site. The resource plan will identify site protection measures, data recovery methods, or both.

Agriculture

The impact to agricultural lands from the proposed project will be temporary during the construction phase of the project.

Several environmental design features will be incorporated into the project to minimize the impact of construction on adjacent agricultural activities. No additional mitigation is proposed. Environmental design features include the following:

- The proposed pipeline has been routed at the edge of fields and avoids mechanical irrigation circles in almost all cases.

- As part of landowner easements, OPL has agreed to route the line along property or field boundaries to avoid impact to orchards or crops such as asparagus which would have long-term impacts should the pipeline be trenched through the asparagus field.

- To the extent possible, construction will also be timed to avoid going through cropped hay or grass fields. If it is not possible to avoid these fields during the growing season, the payment for easements will also include the expected value of the particular crop for the season lost during construction.

- Wherever feasible, construction activities will occur outside of the planting/growing/harvesting period to minimize cropland productivity impacts.

- Compensation to farmers for crop removal and/or damage or lost productivity caused by the construction activities will be negotiated based on actual impact.

- Following construction, the agricultural lands will be restored to their pre-existing soil types and graded levels, and agricultural activities will be able to resume over the top of the pipeline.
- Compensation to farmers for land permanently removed from productive use by construction of the project will be negotiated based on the productive use of that land.
- Equipment cleaning and washing procedures will be implemented to prevent the spread of noxious weeds.
- OPL will coordinate construction activities with farmers to ensure (1) livestock access to feeding and watering stations, and (2) continued access across the right-of-way for farm equipment.
- After the pipe has been lowered into the trench, the trench will be partially backfilled with excavated soil. The remaining top 8 inches of the trench will be backfilled with topsoil. Compacted soil in the work areas adjacent to the backfilled trench will be loosened by tilling with a disk tiller as part of the right-of-way restoration.
- The pipeline corridor will be replanted with native vegetation or as requested by the landowner after completion of construction.
- Fences and gates removed during construction will be replaced.
- A minimum of 4' of soil cover will be placed over the pipeline where deep tilling occurs.

TRANSPORTATION

Mitigation measures that will be employed during construction include the following:

- Workers will be transported to the job site via bus and using state highways and the pipeline access road as much as possible.
- On Kuhn Road, SR 26, and Glade North Road, the pipe will be laid outside of the roadway right-of-way prism in lieu of the middle of the road.
- When trenching across roads, every effort will be made to maintain one lane of traffic through the use of flaggers and steel plates over open trench areas.
- If construction is not completed during work hours, all trenches across public roads will either be backfilled to grade or heavy steel plates will be placed across the trench and the location appropriately marked with warning signs prior to the completion of the day's work activities.

- Temporary closures will be planned to avoid peak travel times.

- Security patrols will be provided at each job site to assure the safety of the public and to the contractor's equipment.

Parking

- Most pipeline workers will be transported from the construction yard, or directly from their hotels to the job site by bus.

- Only construction-related vehicles will be allowed on the job site.

- Parking areas for construction vehicles will be clearly marked and enforced to protect sensitive areas adjacent to the pipeline construction zone.

Movement/Circulation of People or Goods

- In order to ensure safe utilization of the construction areas, pipe staging areas, construction yards, and construction sites (pipeline) will be patrolled by security personnel.

- The pipe staging areas and construction yards will be fenced.

- At the pipeline, open trenches through roadways will be covered during all nonconstruction hours.

- During construction, the public will generally not be allowed access to the pipeline right-of-way. Only land owners and the pipeline owner will have access to the right-of-way.

- After construction is completed, the roads will be returned to preconstruction standards unless otherwise agreed upon by the land owner or agency with jurisdiction over the road.

Traffic Hazards

Mitigation measures for construction are as follows:

- State highways will be utilized as much as is practical for transporting of pipe segments from the pipe staging areas to minimize impacts on local roadways.

- Pilot vehicles will be used where necessary to assist pipe distribution trucks to negotiate curves and hills in mountainous regions.

- Boring pits will be constructed as far from the traveled way as is possible and the boring sites will be protected with concrete barriers to prevent accidents if required for a specific site.

No mitigation measures are proposed for operation as no impacts are expected to occur.

PUBLIC SERVICES AND UTILITIES

The overall impact to most public services and utilities is expected to be minor and short-term. Mitigative measures for project-related impacts are described below:

- Construction activities will be coordinated with local police and fire departments, and emergency medical service providers to ensure access to all locations along the pipeline route in the case of an emergency.

- Stringent construction health and safety measures will be enforced to reduce the potential for accidents, particularly during the welding phase.

- To help mitigate loss of access and other traffic related impacts, adequate traffic control and signage, indicating closures and alternate routes, will be provided.

- Construction vehicle trips in and out of the immediate construction zone will be coordinated and scheduled away from "rush-hour" periods, to minimize general traffic disruption.

- Noise and dust problems generated by construction will be mitigated through the use of properly muffled construction equipment, and by the use of approved dust control methods.

- During construction, precautions will be used to ensure that excavations do not damage underground utilities.

- During construction, all attempts will be made to keep impacts to recreation facilities to a minimum. Through-access on recreation trails will be maintained as much as practicable.

- During operation, the pipeline will be buried in a clearly marked right-of-way to reduce the chance of accidental third party damage.

- The Kittitas Terminal will have a fire detection and suppression system. OPL will only expect responding fire personnel to establish a safety perimeter around that facility and manage access and evacuation if necessary until terminal staff arrive.

- OPL will enter into local agreements with the vicinity fire departments for training, additional response materials, or other needs to perform this limited function.

- The Kittitas Terminal will have a security system.

SOCIOECONOMICS

The socioeconomic effects of the proposed action will be predominately beneficial, in the form of temporary increases in jobs, personal income, and sales taxes during the construction phase. On any large project, the winding down of construction work can have a depressive effect upon some community economies which have built up business activity in support of the project, but it is unlikely in this case, because of the project's short duration and mobile worksites. The magnitude of each spread's work relative to the scope and depth of economic activity in the surrounding areas is unlikely to be large enough to be destabilizing. No mitigating measures are therefore recommended.

Appendix D. Table D-1. Fish That Occur at Pipeline Waterway Crossings[a]

Waterway	Crossing Number[b]	Atlas Page[c]	Crossing Type[d]	Fish That Occur at Pipeline Waterway Crossings	
				Salmonids[e]	Non-Salmonids[f]
Little Bear Creek	1	1	D	CT, SS, RS	COT, TS, WL, SD
Unknown	4	1	UC	CT, SS	COT
Ricci Creek	9	4	D	CT	COT
Snoqualmie River	11	5	Bridge	CT, RB, BC, DV, SCT, SHW, SHS, CF, SS, CH, PS	COT, WF, LRS, TS, PL, WL, RL, NSF, GS, WS, LND, SD, RS, PM
Peoples Creek	14	6	OC	CT, SS	COT, WL
Peoples Creek	15	6	F	CT	COT, WL
Unnamed	17	7	OC	CT	COT, WL
Unnamed	18	7	F	CT, SS	COT, WL
N.F. Cherry Creek	19	8	F or D	CT, SS	COT
Cherry Creek	20	8	D or F	CT, RB, SCT, SHW, SS, CH, PS, CF	COT, WL, PL
Harris Creek	22	9	D	CT, SCT, SS, CH	COT, WL
Unnamed	23	9	F	CT	COT
Tolt River	26	11	D	CT, RB, SHW, SHS, SS, CH, CF, PS	COT, WL, WF
Tolt River (side channel)	27	11	D	CT, RB, SHW, SHS, SS, CH, CF, PS	COT, WL, WF
Griffin Creek	28	12	D	CT, SS	WL, COT
Unnamed	29	12	OC	D	D
Unnamed	31	12	OC	D	D
Tokul Creek	34	14	Bridge	CT, EB	WL, COT
Unnamed	35	14	OC	CT	COT
Snoqualmie River	38	14	Bridge	CT, RB	COT, WF, WL, LRS
Meadowbrook Slough	39	15	Bridge	CT	COT

Table D-1. Continued

Waterway	Crossing Number[b]	Atlas Page[c]	Crossing Type[d]	Fish That Occur at Pipeline Waterway Crossings	
				Salmonids[e]	Non-Salmonids[f]
Meadowbrook Slough	39A	15	Bridge	**CT**	COT
Unnamed	41	15	Bridge	**CT**	COT
S.F. Snoqualmie R.	42	15	Bridge	**CT. RB**	COT, WF, WL, LRS, LND
S.F. Snoqualmie R.	43	17	Bridge	**CT. RB**	CPT. WF, WL, LRS, LND
Boxley Creek	44	17	F or D	**CT. RB**	COT
Unnamed	50	19	OC	**CT. RB**	COT
Unnamed	51	19	OC	NF	NF
Change Creek	52	19	Bridge	**CT. RB**	COT
Hall Creek	53	19	WET	**CT. RB**	COT
Unnamed	54	19	OC	NF	NF
Unnamed	55	19	OC	**CT. RB**	COT
Unnamed	56	19	OC	NF	NF
Mine Creek	57	19	WET	**CT. RB**	COT
Wood creek	59	20	OC	D	D
Alice Creek	60	20	OC	D	D
Carter Creek	72	20	F or D	**CT. RB**	COT
Unnamed	73	22	UC	NF	NF
Unnamed	73A	22	UC	NF	NF
Unnamed (USFS)	74	22	UC	NF	NF
Hansen Creek (USFS)	75	22	F or D	**CT**	COT
Unnamed (USFS)	77	22	UC	**CT. RB**	COT
Humpback Creek (USFS)	78	23	WET	**CT**	COT
Olallie Creek	82	24	D	D	D
Rockdale Creek	84	24	Avoided	D	D
Mill Creek (USFS)	86	26	OC	**RB, WCT, BC,** EB, **K**	COT, MS, **PW**

Table D-1. Continued

Waterway	Crossing Number[b]	Atlas Page[c]	Crossing Type[d]	Fish That Occur at Pipeline Waterway Crossings	
				Salmonids[e]	Non-Salmonids[f]
Cold Creek (USFS)	88	26	OC	**RB, WCT, BC,** EB, **K**	COT, MS, **PW**
Roaring Creek (USFS)	97	27	D	**RB, WCT, BC,** EB, **K**	COT, MS, **PW**, BR
Meadow Creek (USFS)	99	27	D	**RB, WCT, BC,** EB, **K**	COT, MS, **PW**, BR
Mosquito Creek (USFS)	103	28	D	**RB**	COT, MS
Stampede Creek (USFS)	104	28	OC or UC	**RB**	COT, MS
Cabin Creek	117	32	D	**RB, WCT, BC,** EB, **SHS, CSP**	COT, MS, LND, SD, LD, WF
Main Canal	123	32	B	**RB**	COT, MS, LND, SD, LD, WF
Tucker Creek	124	33	F	**RB**	COT, MS, LND, SD, LD
Main Canal	125	33	B	**RB**	COT, MS, LND, SD, LD, WF
Big Creek	127	34	D or F	**RB, WCT, SHS, CSP**	COT, MS, LND, SD, LD, RS
Little Creek (USFS)	129	34	D or F	**RB, WCT, SHS, CSP**	COT, MS, LND, SD, LD, RS
Granite Creek	131	35	F	**RB**	COT
Spex Arth Creek	132	35	UC	**RB**	COT
Tillman Creek	133	37	F	**RB,** EB	COT, MS, LND, SD, LD
Thornton Creek	143	40	D	**RB**	COT, LND, SD, LD
Main Canal	146	41	B	**RB**	COT, LND, SD, LD, WF, LRS
Yakima River	147	41	D	**RB, WCT, BC,** BT, EB, **SHS, CSP**	WF, **SR**, NSF, SD, LND, LRS, BRS, COT, LD, RS, MS, PL, PM, TS
Swauk Creek	151	43	F	**RB, WCT, BC,** EB, **SHS, CSP**	COT, WF, TS, LRS, MS, LND, SD, RS, LD
Reecer Creek	166	46	D	**RB**	COT, WF, LRS, LND, SD, RS, LD
Jones Creek	168	46	D	**RB**	COT, WF, LRS, LND, SD, RS, LD
Jones Creek	169	46	F	**RB**	COT, WF, LRS, LND, SD, RS, LD
Jones Creek	170	47	F	**RB**	COT, WF, LRS, LND, SD, RS, LD
North Branch Canal	174	47	B	**RB**	COT, LND, SD, LD, WF, LRS
Unnamed	176	47	F	**RB**	COT, LND, SD, LD, WF, LRS
Currier Creek	177	47	F	**RB**	COT, LND, SD, LD, WF, LRS

Table D-1. Continued

Waterway	Crossing Number[b]	Atlas Page[c]	Crossing Type[d]	Fish That Occur at Pipeline Waterway Crossings	
				Salmonids[e]	Non-Salmonids[f]
Unnamed	181	48	D or F	**RB**	COT, LND, SD, LD, WF, LRS
Unnamed	182	48	F	**RB**	COT, LND, SD, LD, WF, LRS
Unnamed	183	49	F	**RB**	COT, LND, SD, LD, WF, LRS
Unnamed	185	49	F	**RB**	COT, LND, SD, LD, WF, LRS
Wilson Creek	187	49	D or F	**RB**	COT, WF, LRS, LND, SD, RS, LD
Canal	188	50	B	**RB**	COT, LND, SD, LD, WF, LRS
Canal	189	50	B	**RB**	COT, LND, SD, LD, WF, LRS
Naneum Creek	190	50	D or F	**RB**	COT, WF, LRS, LND, SD, RS, LD
Naneum Creek	193	50	D or F	**RB**	COT, WF, LRS, LND, SD, RS, LD
Cascade Canal	194	51	B	**RB**	COT, LND, SD, LD, WF, LRS
Unnamed	195	51	F	**RB**	COT, WF, LRS, LND, SD, RS, LD
Coleman Creek	196	51	D or F	**RB**	COT, WF, LRS, LND, SD, RS, LD
Canal	198	51	B	**RB**	COT, LND, SD, LD, WF, LRS
Cooke Creek	199	52	WET	**RB**	COT, WF, LRS, LND, SD, RS, LD
Cascade Canal	203	53	B	**RB**	COT, LND, SD, LD, WF, LRS
Parke Creek	205	53	D or F	**RB**	COT, WF, LRS, LND, SD, RS, LD
Parke Creek	206	54	D or F	**RB**	COT, WF, LRS, LND, SD, RS, LD
Highline Canal	207	55	B	**RB**	COT, LND, SD, LD, WF, LRS
Getty's Cove (BLM)	18A	63	D	**RB, BC, SHS, CSP, CF, CS**	**LMB**, **SMB**, **WAL**, **CC**, **WS**, PL, WC, **SR**, CM, BRS, LSS, LNS, NSF, SD, LND, LD, RS, GF, PM, LC, BC, YP, PS, COT CP, BBH, WF
Columbia River (BOR)	223	64	HDD	**RB, BC, SHS, CSP, CF, CS**	**LMB**, **SMB**, **WAL**, **CC**, **WS**, PL, WC, **SR**, CM, BRS, LSS, LNS, NSF, SD, LND, LD, RS, GF, PM, LC, BC, YP, PS, COT CP, BBH, WF
Unnamed (BOR)	232	69	Avoided		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS
Royal Branch Canal (BOR)	233	69	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS
Canal (BOR)	234	69	B		**LMB**, **SMB**, BC, YP, PS, CP, COT, BG

Table D-1. Continued

Waterway	Crossing Number[b]	Atlas Page[c]	Crossing Type[d]	Fish That Occur at Pipeline Waterway Crossings	
				Salmonids[e]	Non-Salmonids[f]
Royal Branch Canal (BOR)	235	70	B		**LMB**, CP, YP, BC, PS, BBH
Canal (BOR)	236	71	B		CP, YP, PS, **LMB**, COT, BG, BC
Crab Creek Lateral (BOR)	237	71	B		**LMB**, COT, CP, YP, PS
Unnamed (USFWS)	240	75	F		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS
Canal (USFWS)	241	75	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS
Canal (USFWS)	242	76	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS
Unnamed (USFWS)	243	77	Avoided		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS
Canal (USFWS)	26-A	78	DRY or F		**LMB**, **SMB**, BC, YP, PS, CP, COT, BG, LND, RS, SD
Canal	26-B	78	DRY or F		**LMB**, **SMB**, BC, YP, PS, CP, COT, BG, LND, RS, SD
Lower Crab Creek	26-C	78	D	**RB,** BT	**LMB**, **SMB**, BC, YP, PS, CP, COT, BG, LND, RS, SD
Lower Crab Creek	26-D	78	D	**RB,** BT	**LMB**, **SMB**, BC, YP, PS, CP, COT, BG, LND, RS, SD
Lower Crab Creek	26-E	79	D or F	**RB,** BT	**LMB**, **SMB**, BC, YP, PS, CP, COT, BG, LND, RS, SD
Canal (USFWS)	26-F	79	DRY or F		**LMB**, **SMB**, BC, YP, PS, CP, COT, BG, LND, RS, SD
Canal (BOR)	26-G	79	DRY or F		**LMB**, **SMB**, BC, YP, PS, CP, COT, BG, LND, RS, SD
Canal (BOR)	26-H	79	DRY or B		**LMB**, **SMB**, BC, YP, PS, CP, COT, BG, LND, RS, SD
Canal (BOR)	26-J	79	DRY or F		**LMB**, **SMB**, BC, YP, PS, CP, COT, BG, LND, RS, SD
Canal (BOR)	255	82	B		CP, YP, PS, **LMB**, COT, BG, BC
Canal (BOR)	256	82	B		**LMB**, COT, CP, YP, PS
Canal (BOR)	257	83	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS
Wahluke Branch Canal	258	84	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS
Unnamed (BOR)	259	85	F or DRY		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS
Canal (BOR)	260	85	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS
Canal (BOR)	261	86	B		**LMB**, COT, PS, YP, CP
Unnamed (BOR)	262	87	F or D		**LMB**, CP, YP, PS, COT, BG, BC
Unnamed (BOR)	263	87	F or OC		**LMB**, CP, YP, PS, COT

Table D-1. Continued

Waterway	Crossing Number[b]	Atlas Page[c]	Crossing Type[d]	Fish That Occur at Pipeline Waterway Crossings	
				Salmonids[e]	Non-Salmonids[f]
Canal (BOR)	264	88	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS
Canal (BOR)	265	88	F or B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS
Canal (BOR)	266	89	F or B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS
Canal (BOR)	267	89	F or B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS
Unnamed (BOR)	268	89	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS
Canal (BOR)	269	89	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS
Potholes Canal (BOR)	270	90	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS
Canal (BOR)	271	90	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS
Canal (BOR)	272	91	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS
Canal (BOR)	273	91	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS
Eltopia Branch Canal (BOR)	274	91	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS
Canal (BOR)	275	92	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS
Canal (BOR)	276	92	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS
Canal (BOR)	277	93	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS
Canal (BOR)	278	93	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS
Canal (BOR)	279	94	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS
Canal (BOR)	280	94	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS
Canal	281	95	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS
Canal	282	95	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS
Esquatzel Diversion Canal (BOR)	283	96	Bridge		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS
Esquatzel Coulee	284	96	F		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS
Canal	285	99	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS
Alternate Route (Originally on Preferred Alignment)					
Parke Creek	208	55	D or F	**RB**	COT, WF, LRS, LND, SD, RS, LD
Parke Creek	209	55	DRY or F	**RB**	COT, WF, LRS, LND, SD, RS, LD

Table D-1. Continued

Waterway	Crossing Number[b]	Atlas Page[c]	Crossing Type[d]	Fish That Occur at Pipeline Waterway Crossings	
				Salmonids[e]	Non-Salmonids[f]
Parke Creek (BLM)	211	55	DRY or F	**RB**	COT, WF, LRS, LND, SD, RS, LD
Lower Crab Creek	244	77	D		**LMB**, **SMB**, BC, YP, PS, CP, COT, BG
Unnamed	246	78	F		CP, YP, BC, PS, BBH

Source: OPL 1998.

[a] Table lists only streams with potential fisheries values.

[b] Dames and Moore's waterway crossing number. Crossing number increases as you follow the pipeline west to east.

[c] Map Atlas page number for the waterway crossing.

[d] Crossing types: HDD - Horizontal Directional Drill; F - Flume; D - Divert; DRY - Dry Trench; WET - Wet Trench; B - Bore; Bridge - Bridge; OC - Over Culvert; UC - Under Culvert

[e] Fish presence at a downstream location is indicated by a "D." Abbreviations for salmonid names are as follows (Underlined abbreviations represent anadromous species and abbreviations in bold represent Washington State Priority Species):

BC or **BC**=Bull Trout	CH=Chum Salmon	**CT**=Cutthroat Trout	**K**=Kokanee	RS=Sockeye Salmon	SHW=Steelhead Trout (Winter-run)
Bt=Brown Trout	CS=Chinook Salmon (Summer-run)	DV=Dolly Varden Trout	PS=Pink Salmon	SCT=Sea-run Cutthroat Trout	SS=Silver (coho) Salmon
CF=Chinook (Fall-run)	CSP=Chinook Salmon (Spring-run)	EB=Eastern Brook Trout	**RB**=Rainbow Trout	SHS=Steelhead Trout (Summer-run)	**WCT**=Westslope Cutthroat Trout

[f] Fish presence at a downstream location is indicated by a "D." Abbreviations for non-salmonid fish names are as follows (Underlined abbreviations represent anadromous species and abbreviations in bold represent Washington State Priority Species)(Whitefish species are listed with non-salmonid species):

BBH=Brown Bullhead	COT=Sculpin	**LMB**=Largemouth Bass	PL=Pacific Lamprey	SD=Speckled Dace	WL=Western Brook Lamprey
BC=Black Crappie	CP=Carp	LND=Longnose Dace	PM=Peamouth	**SMB**=Smallmouth Bass	WS=White Sturgeon
BG=Bluegill	GF=Goldfish	LNS=Longnose Sucker	PS=Pumpkinseed	**SR**=Sandroller	YP=Yellow Perch
BTS=Bridgelip Sucker	GS=Green Sturgeon	LRS=Largescale Sucker	**PW**=Pygmy Whitefish	TS=Three Spined Stickleback	BR=Burbot
CC=Channel Catfish	LC=Lake Chub	MS=Mountain Sucker	RL=River Lamprey	**WAL**=Walleye	WF=Mountain Whitefish
CM=Chiselmouth	LD=Leopard Dace	NSF=Northern Squawfish	RS=Redside Shiner	WC=White Crappie	

BLM = U.S. Bureau of Land Management administered federal lands.
BOR - U.S. Bureau of Reclamation administered federal lands.
USFS = U.S. Forest Service administered federal lands.
USFWS = U.S. Fish and Wildlife Service administered federal lands.

Appendix D. Table D-2. Pipeline Stream Crossings, Fisheries Utilization, Salmonid Habitat, Potential Impact Area, Sensitivity Index, and Proposed Crossing Methods

Waterway and Federal Lands(a)	Tributary to	Crossing Number(b)	Atlas Page(c)	Fisheries Utilization(d)				Salmonid Habitat(e) at Crossing			Pot. Impact(f) (Sq. ft.)	Species Utiliz. Index(g)	Rip. Veg.(h)	DNR Chan(i)	Crossing Type(j)
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.					
SNOHOMISH COUNTY **Sammamish Basin**															
Little Bear Creek	Sammamish River	1	1	2, 3 FC	3	X		X	X	X	609	H	T	2	D
Unnamed	Little Bear Creek	2	1				X				90	N	S	5	F
Unnamed	Little Bear Creek	3	1				X				180	N	S	4	F
Unnamed	Little Bear Creek	4	1	2, 3 FC	3	X		X	X	X	NI	H	N	3	UC
Unnamed	Little Bear Creek	5	2				X				99	N	S	4	D
Unnamed	Little Bear Creek	6	3				X				W	N	-	NA	WETLAND
Snohomish Basin															
Anderson Creek	Snohomish River	7	3				X				NI	N	N	5	UC
Unnamed	Anderson Creek	8	4				X				W	N	-	NA	WETLAND
Snoqualmie Basin															
Ricci Creek	Snoqualmie River	9	4		3	X		X	X		690	M	S	3	D
Unnamed	Snoqualmie River	10	4				X				NC	N	NR	NR	DRY
Unnamed	Snoqualmie River	10A	5				X				NI	N	N	4	UC
Snoqualmie River	Snohomish River	11	5	2, 3, PT	3, PT	2, 3		X	X		NI	H	N	1	BRIDGE
Unnamed	Snoqualmie River	12	5				X				NI	N	-	NA	Avoided

Table D-2. Continued

Waterway and Federal Lands[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat[e] at Crossing			Pot. Impact[f]	Species Utiliz.	Rip. Veg.[h]	DNR Chan[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.	(Sq. ft.)	Index[g]			
Unnamed	Snoqualmie River	13	5				X				198	N	S	4	F
Peoples Creek	Snoqualmie River	14	6	2, 3 FC	3	X		X			NI	H	N	3	OC
Unnamed	Peoples Creek	14A	6				X				99	N	S	4	D
Peoples Creek	Snoqualmie River	15	6		3	X		X			294	M	S	4	F
Unnamed	Peoples Creek	16	6				X				NI	N	N	5	OC
KING COUNTY Snoqualmie Basin															
Unnamed	N.F. Cherry Creek	17	7		3	X		X			NI	M	N	3	OC
Unnamed	N.F. Cherry Creek	18	7	2, 3 FC	3	X		X			345	H	S	3	F
N.F. Cherry Creek	Cherry Creek	19	8	2, 3 FC	3	X			X		345	M	S	3	F or D
Cherry Creek	Snoqualmie River	20	8	2, 3, PT	3	X		X	X	X	1575	H	S	1	D or F
Unnamed	Cherry Creek	21	8				X				W	N	-	NA	WETLAND
Harris Creek	Snoqualmie River	22	9	2, 3 PT	3	X		X	X		768	H	S	2	D
Unnamed	Harris Creek	23	9		3	X		X	X		198	M	S	3	F
Unnamed	Harris Creek	24	9				X				120	N	S	4	F
Unnamed	Harris Creek	25	10				X				W	N	-	NA	WETLAND
Unnamed	Tolt River	25A	11				X				90	N	NR	5	F
Tolt River	Snoqualmie River	26	11	2, 3, PT	3	X		X		X	7872	H	T	1	D
Tolt River (side channel)	Snoqualmie River	27	11	2, 3, PT	3	X		X		X	984	H	T	1	D
Griffin Creek	Snoqualmie River	28	12	2, 3 FC	3	X		X	X	X	471	H	T	1	D

Table D-2. Continued

Waterway and Federal Lands[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat[e] at Crossing			Pot. Impact[f]	Species Utiliz.	Rip. Veg.[h]	DNR Chan[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.	(Sq. ft.)	Index[g]			
Unnamed	Griffin Creek	29	12	D	D	D	X				NI	H	N	5	OC
Unnamed	Griffin Creek	30	12				X				W	N	-	NA	WETLAND
Unnamed	Griffin Creek	31	12	D	D	D	X				NI	H	N	4	OC
Unnamed	Tokul Creek	32	13				X				NI	N	N	4	OC
Unnamed	Tokul Creek	33	14				X				NI	N	-	NA	Avoided
Tokul Creek	Snoqualmie River	34	14		3	X		X	X	X	NI	M	T	1	Bridge
Unnamed	Mill Pond	35	14		3	X		X	X		NI	M	N	3	OC
Unnamed	Mill Pond	36	14				X				48	N	T	5	F
Unnamed	Pond	36A	14				X				NI	N	N or T	4	OC
Unnamed	Pond	37	14				X				NI	N	T	4	OC
Snoqualmie River	Snohomish River	38	14		3	X		X	X	X	NI	M	N	1	BRIDGE
Meadowbrook Slough	Snoqualmie River	39	15		3	X		X	X		NI	M	N	2	BRIDGE
Meadowbrook Slough	Snoqualmie River	39A	15		3	X		X	X		NI	M	NR	2	BRIDGE
Unnamed	S.F. Snoqualmie R.	40	15				X				NI	N	N	5	BRIDGE
Unnamed	S.F. Snoqualmie R.	41	15		3	X			X		NI	M	N	3	BRIDGE
S.F. Snoqualmie R.	Snoqualmie River	42	15		3			X			NI	M	N	1	BRIDGE
S.F. Snoqualmie R.	Snoqualmie River	43	17		3			X			NI	M	N	1	BRIDGE
Boxley Creek	S.F. Snoqualmie R.	44	17		3			X	X	X	1770	M	T	1	F or D
Unnamed	S.F. Snoqualmie R.	44A	17				X				NI	N	N	4	UC
Unnamed	S.F. Snoqualmie R.	45	18				X	•			NI	N	N	3	OC

Table D-2. Continued

Waterway and Federal Lands[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat[e] at Crossing			Pot. Impact[f] (Sq. ft.)	Species Utiliz. Index[g]	Rip. Veg.[h]	DNR Chan[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.					
Unnamed (BLM)	S.F. Snoqualmie R.	46	18				X				NI	N	N	3	OC
Unnamed (BLM)	S.F. Snoqualmie R.	47	18				X				NI	N	N	4	OC
Unnamed	S.F. Snoqualmie R.	48	18				X				NI	N	N	4	OC
Unnamed	S.F. Snoqualmie R.	49	18				X				NI	N	N	4	OC
Unnamed	S.F. Snoqualmie R.	50	19		3	X	D	X		X	NI	M	N	5	OC
Unnamed	S.F. Snoqualmie R.	51	19				D				NI	L	N	5	OC
Change Creek	S.F. Snoqualmie R.	52	19		3	X	D	X	X	X	NI	M	N	3	BRIDGE
Hall Creek	S.F. Snoqualmie R.	53	19		3	X	D	X	X		480	M	G	3	WET
Unnamed	S.F. Snoqualmie R.	54	19				D				NI	L	N	5	OC
Unnamed	S.F. Snoqualmie R.	55	19		3	X	D	X		X	NI	M	N	5	OC
Unnamed	S.F. Snoqualmie R.	56	19				D				NI	N	N	5	OC
Mine Creek	S.F. Snoqualmie R.	57	19		3	X	D	X	X	X	540	M	T	3	WET
Unnamed	S.F. Snoqualmie R.	58	20				X				NI	N	N	5	OC
Wood Creek	S.F. Snoqualmie R.	59	20		D	D					NI	M	N	4	OC
Alice Creek	S.F. Snoqualmie R.	60	20		D	D					NI	M	N	3	OC
Unnamed	Unnamed Tributary	61	20				X				NI	N	N	4	UC

Table D-2. Continued

Waterway and Federal Lands[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat[e] at Crossing			Pot. Impact[f]	Species Utiliz.	Rip. Veg.[h]	DNR Chan[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.	(Sq. ft.)	Index[g]			
Unnamed (USFS)	S.F. Snoqualmie R.	62	20				X				NI	N	N	4	OC
Unnamed (USFS)	S.F. Snoqualmie R	62A	20				X				NI	N	N	5	OC
Unnamed (USFS)	S.F. Snoqualmie R	62B	20				X				NI	N	N	4	OC
Unnamed (USFS)	S.F. Snoqualmie R	62C	20				X				NI	N	N	5	OC
Unnamed (USFS)	Unnamed Tributary	63	20				X				NI	N	N	5	OC
Unnamed (USFS)	S.F. Snoqualmie R.	64	21				X				NI	N	N	5	UC
Unnamed (USFS)	S.F. Snoqualmie R.	65	21				X				NI	N	N	4	OC
Rock Creek (USFS)	S.F. Snoqualmie R.	66	21				X				450	N	N	4	D
Unnamed (USFS)	S.F. Snoqualmie R.	66A	21				X				NI	N	N	3	OC
Harris Creek (USFS)	S.F. Snoqualmie R.	67	21				X				450	N	N	3	D
Unnamed (USFS)	S.F. Snoqualmie R.	67A	21				X				NI	N	N	5	OC
Unnamed (USFS)	S.F. Snoqualmie R.	68	21				X				NI	N	N	4	OC
Unnamed (USFS)	S.F. Snoqualmie R.	69	21				X				NC	N	NR	NR	DRY
Unnamed (USFS)	S.F. Snoqualmie R.	70	21				X				NI	N	T or N	4	UC
Unnamed (USFS)	S.F. Snoqualmie R.	71	21				X				NI	N	T or N	4	UC
Carter Creek	S.F. Snoqualmie R.	72	22		3	X	D		X		768	M	T	3	F or D

Table D-2. Continued

Waterway and Federal Lands[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat[e] at Crossing			Pot. Impact[f]	Species Utiliz.	Rip. Veg.[h]	DNR Chan[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.	(Sq. ft.)	Index[g]			
Unnamed	S.F. Snoqualmie R.	73	22				D				NI	L	T	4	UC
Unnamed	S.F. Snoqualmie R.	73A	22				D				NI	L	N	5	UC
Unnamed (USFS)	Hansen Creek	74	22				D				NI	L	T	5	UC
Hansen Creek (USFS)	S.F. Snoqualmie R.	75	22		3	X	D	X			1182	M	U	3	F or D
Unnamed (USFS)	Pond	76	22				X				NI	N	T or N	4	UC
Unnamed (USFS)	S.F. Snoqualmie R.	77	22		3	X	D				NI	M	T or N	4	UC
Humpback Creek (USFS)	S.F. Snoqualmie R.	78	23		3	D					1119	M	T	3	WET
Unnamed (USFS)	S.F. Snoqualmie R.	79	23				X				W	N	-	NA	WETLAND
Unnamed	S.F. Snoqualmie R.	80	23				X				W	N	-	NA	WETLAND
Unnamed	S.F. Snoqualmie R.	81	23				X				W	N	-	NA	WETLAND
Unnamed	S.F. Snoqualmie R.	82	24				X				240	N	G	5	D
Olallie Creek	S.F. Snoqualmie R.	83	24		D	D					414	M	G	4	D
Rockdale Creek	S.F. Snoqualmie R.	84	24		D	D					NI	M	-	3	Avoided
KITTITAS COUNTY Yakima Basin															
Unnamed (USFS)	Keechelus Lake	85	25				X				NI	N	N	4	OC
Mill Creek (USFS)	Keechelus Lake	86	26		1, 3, T	1, 2		X		X	NI	H	N	3	OC
Unnamed (USFS)	Keechelus Lake	87	26				X				NI	N	N	4	OC
Cold Creek (USFS)	Keechelus Lake	88	26		1, 3, T	1, 2	X	X		X	NI	H	N or S	3	OC
Unnamed (USFS)	Keechelus Lake	89	26				X				NI	N	N	4	OC or UC

Table D-2. Continued

Waterway and Federal Lands[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat[e] at Crossing			Pot. Impact[f]	Species Utiliz.	Rip. Veg.[h]	DNR Chan[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.	(Sq. ft.)	Index[g]			
Unnamed (USFS)	Keechelus Lake	90	26				X				NI	N	N	4	OC or UC
Unnamed (USFS)	Keechelus Lake	91	26				X				NI	N	N	5	OC or UC
Unnamed (USFS)	Keechelus Lake	92	26				X				NI	N	N	5	OC or UC
Unnamed (USFS)	Keechelus Lake	93	26				X				NI	N	N	4	OC or UC
Unnamed (USFS)	Keechelus Lake	94	26				X				NI	N	N	4	OC or UC
Unnamed (USFS)	Keechelus Lake	95	26				X				NI	N	N	5	OC or UC
Unnamed (USFS)	Keechelus Lake	96	27				X				NI	N	N	5	OC or UC
Roaring Creek (USFS)	Keechelus Lake	97	27		1, 3, T	I, 2	X	X	X	X	846	H	N	2	D
Unnamed (USFS)	Keechelus Lake	98	27				X				NI	N	N	5	OC or UC
Meadow Creek (USFS)	Keechelus Lake	99	27		1, 3, T	I, 2	X	X	X	X	1200	H	N	3	D
Unnamed	Pond	100	27				X				NI	N	N	5	OC or UC
Unnamed	Yakima River	101	28				X				NI	N	N	4	OC or UC
Unnamed (USFS)	Yakima River	102	28				X				NI	N	N	4	OC or UC
Mosquito Creek (USFS)	Yakima River	103	28		3	X		X	X	X	471	M	S	3	D
Stampede Creek (USFS)	Yakima River	104	28		3	X		X	X	X	NI	M	N	4	OC or UC
Unnamed	Yakima River	105	29				X				NI	N	N	4	OC
Unnamed	Yakima River	106	29				X				NI	N	N	4	OC
Unnamed (USFS)	Yakima River	107	29				X				NI	N	N	4	OC
Unnamed	Yakima River	108	30				X				NI	N	N	4	OC
Unnamed	Yakima River	109	30				X				NI	N	N	4	OC
Unnamed	Yakima River	110	30				X				NI	N	N	4	OC
Unnamed	Yakima River	111	30				X				NI	N	N	3	OC
Unnamed	Yakima River	112	30				X				NI	N	N	4	OC
Unnamed		113	30				X				NC	N	NR	NR	DRY
Unnamed		114	30				X				NI	N	N	5	OC
Unnamed	Yakima River	115	31				X				NI	N	N	4	OC
Unnamed	Yakima River	116	31				X				NI	N	N	4	OC

Table D-2. Continued

Waterway and Federal Lands[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat[e] at Crossing			Pot. Impact[f]	Species Utiliz.	Rip. Veg.[h]	DNR Chan[f]	Crossing Type[f]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.	(Sq. ft.)	Index[g]			
Cabin Creek	Yakima River	117	31	2, 3, PT	3, T	X		X		X	984	H	S	1	D
Unnamed	Pond	118	31				X				NC	N	NR	NA	DRY
Unnamed	Pond	119	31				X				NI	N	N	NA	OC
Unnamed		120	31				X				NC	N	NR	NR	DRY
Unnamed	Lake Easton	121	32				X				NC	N	NR	MR	DRY
Unnamed	Yakima River	122	32				X				492	N	G	5	D or F
Main Canal		123	32		3	X					NI	L	N	NA	B
Tucker Creek	Yakima River	124	33		3	X				X	345	M	S	3	F
Main Canal		125	33		3	X					NI	L	N	NA	B
Unnamed	Big Creek	126	33				X				NI	N	N	5	UC
Big Creek	Yakima River	127	34	2, 3, PT	3	X		X		X	885	H	S	1	D or F
Unnamed	Yakima River	128	34				X				NC	N	NR	NR	DRY
Little Creek (USFS)	Yakima River	129	34	2, 3, PT	3	X		X		X	1182	H	S	2	D or F
Peterson Creek	Granite Creek	130	35				X				294	N	S	4	D or F
Granite Creek	Yakima River	131	35		3	X		X		X	60	M	S	5	F
		131a	35												
Spex Arth Creek	Yakima River	132	36		3	X		X			NI	M	N	4	UC
Tillman Creek	Yakima River	133	37		3	X		X	X		99	M	S	4	F
Unnamed	Tillman Creek	134	37				X				99	N	S	5	F
Unnamed		135	38				X				198	N	S	4	F
Unnamed		136	38				X				NC	N	NR	NR	DRY
Unnamed		137	39				X				78	N	S	5	F
Unnamed		138	39				X				NC	N	NR	NR	DRY
Unnamed		139	39				X				NC	N	NR	NR	DRY
Unnamed		140	39				X				NC	N	NR	NR	DRY

Table D-2. Continued

Waterway and Federal Lands[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat[e] at Crossing			Pot. Impact[f]	Species Utiliz.	Rip. Veg.[h]	DNR Chan[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.	(Sq. ft.)	Index[g]			
Unnamed		141	40				X				99	N	S	5	F
Unnamed		142	40				X				294	N	S	4	F
Thornton Creek	Yakima River	143	40		3	X		X	X		147	M	S	5	D
Unnamed		144	40				X				NC	N	NR	NR	DRY
Unnamed		145	41				X				NC	N	NR	NR	DRY
Main Canal		146	41		3	X					NI	L	N	NA	B
Yakima River	Columbaia River	147	41	2, 3, PT	3, T	2		X		X	2166	H	T	1	D
Unnamed	Yakima River	148	42				X				W	N	-	NA	WETLAND
Unnamed	Pond	149	42				X				NC	N	NR	NR	DRY
		149a	42												
Unnamed	Swauk Creek	150	43				X				198	N	U	4	DRY
Swauk Creek	Yakima River	151	43	2, 3, PT	3, T	X		X		X	1476	H	S	2	F
Unnamed	Swauk Creek	152	43				X				NC	N	NR	NR	DRY
Unnamed	Swauk Creek	153	43				X				NC	N	NR	NR	DRY
Unnamed	Dry	154	44				X				NC	N	NR	NR	DRY
Unnamed		155	44				X				NC	N	NR	NR	DRY
Dry Creek	Yakima River	156	44				X				393	N	S	4	DRY
Dry Creek	Yakima River	157	45				X				294	N	G	4	F or D
Unnamed	Dry Creek	158	45				X				99	N	G	4	F or D
Unnamed	Dry Creek	159	45				X				294	N	G	5	D or F
Dry Creek	Yakima River	160	45				X				NC	N	NR	NR	DRY
Dry Creek	Yakima River	161	45				X				492	N	G	5	D or F
Unnamed	Yakima River	162	45				X				90	N	G	5	F
Unnamed	Yakima River	163	46				X				165	N	G	5	F
Unnamed	Yakima River	163A	46				X				90	N	NR	5	DRY
Unnamed	Yakima River	163B	46				X				60	N	NR	5	DRY

Table D-2. Continued

Waterway and Federal Lands[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat[e] at Crossing			Pot. Impact[f]	Species Utiliz.	Rip. Veg.[h]	DNR Chan[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.	(Sq. ft.)	Index[g]			
Unnamed	Yakima River	163C	46				X				60	N	NR	5	DRY
Unnamed	Yakima River	164	46				X				NC	N	G	5	F
Unnamed	Yakima River	165	46				X				60	N	G	3	F
Unnamed	Yakima River	165A	46				X				60	N	NR	3	F
Reecer Creek	Yakima River	166	46		3	X			X	X	90	M	S	3	D
Unnamed	Yakima River	166A	46				X				90	N	NR	5	DRY
Unnamed	Yakima River	167	46				X				90	N	G	5	F
Jones Creek	Yakima River	168	46		3	X		X			108	M	S	3	D
Jones Creek	Yakima River	169	46		3	X		X			108	M	G	3	F
Jones Creek	Yakima River	170	47		3	X		X			150	M	G	4	F
Unnamed	Pond	171	47				X				30	N	G	5	F or DRY
Unnamed	Currier Creek	172	47				X				120	N	S	4	F or DRY
Unnamed	Currier Creek	173	47				X				90	N	G	5	F
North Branch Canal	Yakima River	174	47		3	X					NI	L	N	NA	B
Unnamed	Currier Creek	175	47				X				246	N	S	4	D or F
Unnamed	Currier Creek	176	47		3	X		X			C	L	NR	NR	F
Currier Creek	Yakima River	177	47		3	X				X	609	M	S	4	F
Unnamed	Currier Creek	178	47				X				90	N	G	5	F
Unnamed	Currier Creek	179	48				X				60	N	G	5	F
Currier Creek	Yakima River	180	48				X				90	N	S	4	F
Unnamed	Yakima River	181	48		3	X					C	L	NR	NR	D or F
Unnamed	Yakima River	182	48		3	X					C	L	NR	NR	F
Unnamed		183	49		3	X					C	L	NR	NR	F
Unnamed	Yakima River	184	49				X				207	N	S	5	D or F
Unnnamed	Yakima River	185	49		3	X					C	L	NR	NR	F
Mercer Creek	Yakima River	186	49				X				690	N	T	5	D or F
Wilson Creek	Yakima River	187	49		3	X		X			690	M	S	4	D or F

Table D-2. Continued

Waterway and Federal Lands[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat[e] at Crossing			Pot. Impact[f]	Species Utiliz.	Rip. Veg.[h]	DNR Chan[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.	(Sq. ft.)	Index[g]			
Canal		188	50		3	X					NI	L	N	NA	B
Canal		189	50		3	X					NI	L	N	NA	B
Naneum Creek	Yakima River	190	50		3	X		X			393	M	S	4	D or F
Unnamed	Naneum Creek	191	50				X				NI	N	-	NA	Avoided
Unnamed	Naneum Creek	192	50				X				NI	N	-	NA	Avoided
Naneum Creek	Yakima River	193	50		3	X		X			393	M	G	4	D or F
Cascade Canal		194	51		3	X					NI	L	N	NA	B
Unnamed	Coleman Creek	195	51		3	X					C	L	NR	NR	F
Coleman Creek	Yakima River	196	51		3	X		X			492	M	T	4	D or F
Unnamed	Coleman creek	197	51				X				N/A	N	S	5	D or F
Canal		198	51		3	X					NI	L	NR	NA	B
Cooke Creek	Cherry Creek	199	52		3	X					N/A	M	G	4	WET
Caribou Creek	Cherry Creek	200	52				X				NI	N	G	4	Bridge
Parke	Cherry Creek	201	52				X				NC	N	NR	NR	DRY
Unnamed	Parke Creek	202	52				X				NC	N	NR	NR	DRY
Cascade Canal		203	53		3	X					NI	L	N	NA	B
Unnamed	Parke Creek	204	53				X				NC	N	G	5	D or F
Parke Creek	Cherry Creek	205	53		3	X		X			180	M	S	3	D or F
Unnamed	Cherry Creek	205A	54				X				90	N	NR	5	DRY
Parke Creek	Cherry Creek	206	54		3	X		X			180	M	S	4	D or F
Highline Canal		207	55		3	X					NI	L	N	NA	B
Unnamed	Parke Creek	1-F	55				X				NC	N	NR	5	F or D
Unnamed	Parke Creek	1-E	55				X				60	N	NR	4	DRY
Parke Creek	Cherry Creek	1-A	55				X				45	N	NR	5	DRY
Canal		1-I	55				X				C	N	NR	NA	F
Canal		1-J	55				X				C	L	NR	NA	D or F
Unnamed	Parke Creek	1-G	56				X				450	N	NR	4	DRY or F

Table D-2. Continued

Waterway and Federal Lands[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat[e] at Crossing			Pot. Impact[f]	Species Utiliz.	Rip. Veg.[h]	DNR Chan[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.	(Sq. ft.)	Index[g]			
Unnamed	Parke Creek	1-B	56				X				450	N	NR	4	DRY or F
Unnamed	Parke Creek	1-C	56				X				300	N	NR	5	DRY
Unnamed	Parke Creek	1-K	56				X				120	N	NR	5	DRY
Columbia Basin															
Unnamed	Ryegrass Coulee	1-D	57				X				90	N	NR	5	DRY
Unnamed	Ryegrass Coulee	1-L	57				X				120	N	NR	5	DRY
Unnamed	Rocky Coulee	1-H	58				X				90	N	NR	5	DRY or F
Unnamed	Rocky Coulee	1-M	59				X				90	N	NR	5	DRY
Unnamed	Royegrass Coulee	9-B	61				X				90	N	NR	5	DRY
Ryegrass Coulee	Columbia River	9-A	61				X				360	N	N	3	DRY
Unnamed	Ryegrass Coulee	14-A	61a				X				360	N	S	5	DRY
Unnamed (DOD)	Columbia River	16-L	62a				X				NC	N	NR	NA	DRY
Getty's Cove (BLM)	Columbia River	18-A	63	2,3,E, PT	3, PT	2,3					15000	H	G	1	D
Unnamed	Columbia River	23-A	63				X				150	N	S	5	DRY
Columbia River (BOR)	Pacific Ocean	223	64	2, 3, E, PT	3, PT	2, 3		X	X		NI	H	N	1	HDD
GRANT COUNTY Columbia Basin															
Unnamed (BOR)	Columbia River	224	65				X				NC	N	NR	NR	DRY
Unnamed (BOR)	Nunnally Lakes	225	66				X				90	N	S	5	F
Unnamed	Nunnally Lakes	226	67				X				NC	N	-	NA	DRY
Unnamed	Nunnally Lakes	227	67				X				75	N	-	NA	F
Unnamed (BOR)	Nunnally Lakes	228	67				X				120	N	S	4	F
Unnamed	Nunnally Lakes	229	68				X				NC	N	NR	NR	DRY
Unnamed	Lower Crab Creek	230	69				X				198	N	G	5	F

Table D-2. Continued

Waterway and Federal Lands[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat[e] at Crossing			Pot. Impact[f]	Species Utiliz.	Rip. Veg.[h]	DNR Chan[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.	(Sq. ft.)	Index[g]			
Unnamed	Lower Crab Creek	231	69				X				99	N	G	5	F
Unnamed (BOR)	Lower Crab Creek	232	69			3					NI	L	-	NA	Avoided
Royal Branch Canal (BOR)	Lower Crab Creek	233	69			3					NI	L	N	NA	B
Canal (BOR)	Lower Crab Creek	234	69			3					NI	L	N	NA	B
Royal Branch Canal (BOR)	Lower Crab Creek	235	70			3					NI	L	N	NA	B
Canal (BOR)	Lower Crab Creek	236	71			3					NI	L	N	NA	B
Crab Creek Lateral (BOR)	Lower Crab Creek	237	71			3					NI	L	NR	NR	B
Unnamed	Lower Crab Creek	238	73				X				NC	N	NR	NR	F or Dry
Unnamed	Lower Crab Creek	239	74				X				225	N	G	5	F
Unnamed (USFWS)	Lower Crab Creek	240	75			3					C	L	NR	NR	F
Canal (USFWS)		241	75			3					NI	L	NR	NA	B
Canal (USFWS)		242	76			3					NI	L	NR	NA	B
Unnamed (USFWS)	Lower Crab Creek	243	77			3					NI	L	NR	NA	Avoided
Canal (USFWS)	Lower Crab Creek	26-A	78			3					C	L	NR	NA	DRY or F
Canal	Lower Crab Creek	26-B	78			3					C	L	NR	NA	DRY or F
Lower Crab Creek	Columbia River	26-C	78		3	3					600	M	G	2	D
Lower Crab Creek	Columbia River	26-D	78		3	3					600	M	G	2	D
Lower Crab Creek	Columbia River	26-E	79		3	3					1500	M	G	2	F or D
Canal (USFWS)		26-F	79			3					C	L	NR	NA	DRY or F

Table D-2. Continued

Waterway and Federal Lands[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat[e] at Crossing			Pot. Impact[f]	Species Utiliz.	Rip. Veg.[h]	DNR Chan[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.	(Sq. ft.)	Index[g]			
Canal (BOR)		26-G	79			3					C	L	NR	NA	DRY or F
Canal (BOR)		26-H	79			3					C	L	NR	NA	DRY or B
Unnamed (BOR)		26-I	79				X				NC	N	NR	NA	DRY
Canal (BOR)		26-J	79			3					C	L	NR	NA	DRY or F
Unnamed (BOR)		252	80				X				NC	N	NR	NR	DRY
Unnamed (BOR)		253	80				X				NC	N	NR	NR	DRY
Unnamed		254	80				X				NC	N	NR	NR	DRY
ADAMS COUNTY Columbia Basin															
Canal (BOR)		255	82			3					NI	L	N	NA	B
Canal (BOR)		256	82			3					NI	L	N	NA	B
FRANKLIN COUNTY Columbia Basin															
Canal (BOR)		257	83			3					NI	L	N	NA	B
Wahluke Branch Canal		258	84			3					NI	L	N	NA	B
Unnamed (BOR)		259	85			3					C	L	NR	NR	F or DRY
Canal (BOR)		260	85			3					NI	L	N	NA	B
Canal (BOR)		261	86			3					NI	L	N	NA	B
Unnamed (BOR)	Eagle Lake Wetland	262	87			3					780	L	T	3	F or D
Unnamed (BOR)		263	87			3					120	L	S	5	F or OC
Canal (BOR)		264	88			3					NI	L	N	NA	B
Canal (BOR)		265	88			3					NI	L	NR	NA	F or B
Canal (BOR)		266	89			3					NI	L	NR	NA	F or B
Canal (BOR)		267	89			3					NI	L	NR	NA	F or B
Unnamed (BOR)		268	89			3					NI	L	N	NR	B
Canal (BOR)		269	89			3					NI	L	N	NA	B

Table D-2. Continued

Waterway and Federal Lands[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat[e] at Crossing			Pot. Impact[f]	Species Utiliz.	Rip. Veg.[h]	DNR Chan[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.	(Sq. ft.)	Index[g]			
Potholes Canal (BOR)		270	90			3					NI	L	N	NA	B
Canal (BOR)		271	90			3					NI	L	N	NA	B
Canal (BOR)		272	91			3					NI	L	N	NA	B
Canal (BOR)		273	91			3					NI	L	N	NA	B
Eltopia Branch Canal (BOR)		274	91			3					NI	L	N	NA	B
Canal (BOR)		275	92			3					NI	L	N	NA	B
Canal (BOR)		276	92			3					NI	L	N	NA	B
Canal (BOR)		277	93			3					NI	L	N	NA	B
Canal (BOR)		278	93			3					NI	L	N	NA	B
Canal (BOR)		279	94			3					NI	L	N	NA	B
Canal (BOR)		280	94			3					NI	L	N	NA	B
Canal		281	95			3					NI	L	N	NA	B
Canal		282	95			3					NI	L	N	NA	B
Esquatzel Diversion Canal (BOR)		283	96			3					NI	L	N	NA	Bridge
Esquatzel Coulee		284	96			3					630	L	G	1	F
Canal		285	99			3					NI	L	N	NA	B
KITTITAS COUNTY Yakima Basin															
Alternate Route (Originally on Preferred Alignment)															
Parke Creek	Cherry Creek	208	55		3	X		X			513	M	S	5	D or F
Parke Creek	Cherry Creek	209	55		3	X		X			240	M	S	5	F or DRY
Unnamed (BLM)	Parke Creek	210	55				X				90	N	G	5	F or DRY
Parke Creek (BLM)	Cherry Creek	211	55		3	X		X			300	M	G	5	F or DRY
Unnamed (DOD)	Parke Creek	212	56				X				NC	N	NR	NR	F or DRY
Unnamed (DOD)	Parke Creek	213	56				X				NC	N	NR	NR	F or DRY
Unnamed (DOD)	Parke Creek	214	56				X				NC	N	NR	NR	F or DRY
Unnamed (DOD)	Parke Creek	215	57				X				NC	N	S	4	F or DRY

Table D-2. Continued

Waterway and Federal Lands[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat[e] at Crossing			Pot. Impact[f]	Species Utiliz.	Rip. Veg.[h]	DNR Chan[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.	(Sq. ft.)	Index[g]			
Columbia Basin															
Unnamed (DOD)	Sagebrush Spring	216	61				X				444	N	S	4	F or DRY
Unnamed (DOD)	Sagebrush Spring	217	61				X				300	N	S	5	F or DRY
Unnamed (DOD)	Canyon Creek	218	62				X				360	N	S	4	F or DRY
Unnamed (DOD)	Canyon Creek	219	63				X				450	N	S	4	F or DRY
Middle Canyon Creek (DOD)	Johnson Creek	220	63				X				600	N	S	4	F or D
Middle Canyon Creek (DOD)	Johnson Creek	221	63				X				600	N	S	4	F or D
Johnson Creek (DOD)	Columbia River	222	63	2, 3						X	690	H	S	3	F
Alternate Route #8															
Ryegrass Coulee (DOD)	Columbia River	8-A	60				X				720	N	N	3	D
Alternate Route #12															
Unnamed	Columbia River	12-A	61				X				300	N	S	5	DRY
Alternate Route #16															
Unnamed	Columbia River	16-A	61a				X				180	N	G	5	DRY
Unnamed	Columbia River	16-B	61a				X				300	N	G	5	DRY
Unnamed	Columbia River	16-C	61a				X				NC	N	NR	NR	DRY
Unnamed	Columbia River	16-D	62a				X				150	N	G	5	DRY
Unnamed	Columbia River	16-E	62a				X				450	N	G	5	DRY
Unnamed	Columbia River	16-F	62a				X				150	N	G	5	DRY
Unnamed	Columbia River	16-G	62a				X				180	N	G	5	DRY
Unnamed	Columbia River	16-H	62a				X				180	N	G	5	DRY
Unnamed	Columbia River	16-I	62a				X				NC	N	G	NR	DRY
Unnamed	Columbia River	16-J	62a				X				180	N	NR	5	DRY
Unnamed (DOD)	Columbia River	16-K	62a				X				90	N	G	5	DRY

Table D-2. Continued

Waterway and Federal Lands[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat[e] at Crossing			Pot. Impact[f] (Sq. ft.)	Species Utiliz. Index[g]	Rip. Veg.[h]	DNR Chan[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.					
Alternate Route #19															
Canyon Creek (DOD)	Columbia River	19-A	63				X				600	N	G	3	F or D
Alternate Route #20															
Johnson Creek (DOD)	Columbia River	20-A	63				X				690	N	S	3	F
Alternate Route #22															
Unnamed (DOD)	Columbia River	22-A	63				X				900	N	S	3	DRY
Unnamed (DOD)	Columbia River	22-B	63				X				450	N	NR	4	DRY
Alternate Route #23															
Unnamed (BLM)	Columbia River	23-B	63				X				90	N	S	5	DRY
Alternate Route #24															
Sand Hollow (BOR)	Columbia River	24-A	63a				X				NI	N	G	3	B
Canal (BOR)		24-A	64b				X				C	N	G	4	D or F
Unnamed (BOR)		24-C	65				X				210	N	-	NR	DRY
GRANT COUNTY Columbia Basin															
Alternative Route (Originally on Preferred Alignment)															
Lower Crab Creek	Columbia River	244	77			3					1674	L	NR	2	D
Unnamed	Lower Crab Creek	245	77				X				900	N	NR	2	F
Unnamed	Lower Crab Creek	246	78			X					984	L	NR	2	F
Unnamed (BOR)		247	78				X				NC	N	NR	NA	DRY
Unnamed (BOR)		248	79				X				NC	N	NR	NA	DRY
Unnamed		244	79				X				NC	N	NR	NA	DRY
Unnamed		250	79				X				198	N	NR	S	D or F
Unnamed		251	80				X				198	N	NR	S	D or F

Table D-2. Continued

Waterway and Federal Lands[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat[e] at Crossing			Pot. Impact[f] (Sq. ft.)	Species Utiliz. Index[g]	Rip. Veg.[h]	DNR Chan[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.					

Source: Based on OPL 1998.

(a) Symbol indicates that the waterway is under the jurisdiction of the Army Corps of Engineers (ACOE) pursuant to Section 404 of the Clean Water Act. Symbol (n) indicates that the waterway is not an ACOE jurisdictional stream. Symbol (u) indicates that the ACOE jurisdictionality of the waterway is unknown at this time, additional field surveys will be completed to determine ACOE jurisdictionality. Symbol (w) indicates that the waterway is actually a wetland at the pipeline crossing point. Symbol (d) indicates that at the pipeline crossing point there is no defined channel. Symbol (c) indicates that the waterway is an irrigation canal with little or no fisheries value.

(b) Dames and Moore's waterway crossing number. Crossing number increases as you follow the pipeline west to east.

(c) Map Atlas (see Dames & Moore, 1996a) page number for the waterway crossing.

(d) Fisheries utilization: ANAD- anadromous fish; RES SAL-resident salmonids; OTHER SPECIES-other fish species; NO FISH- no known fisheries utilization. Fish presence at a downstream location is indicated by a "D". A "D" in the "NO FISH" column indicates that sediment transport at the crossing has the potential of impacting fisheries resources in streams that the crossing stream is tributary to. Data from Washington Rivers Information System (WARIS) (WDFW, 1995a). If Washington State Priority species are present, the priority criteria are listed. If a species present is proposed for listing as threatened within the next year, it is noted by the symbol 'PT' and if a species present is listed as endangered, it is noted by the symbol 'E.'

(e) Salmonid habitat types present at specific or general pipeline crossing locations.

(f) POT IMPACT - Potential impacted area for stream crossings. The area in square feet is calculated by multiplying the distance across a full stream channel in feet times a 30' wide trench cut. NI=no impact because no physical disturbance to stream channel occurs, NA=No information available, NC=No defined channel, C=Canal or irrigation ditch, and W=Wetland.

(g) Criteria for Sensitivity Index ratings are: HIGH (H)-stream contains anadromous fish, Washington state priority species (priority level 1 or 2) or a species expected to become a federal candidate for listing as threatened or endangered within the next 2 years; MODERATE (M)-stream contains resident salmonids and is not an irrigation canal: LOW (L)-stream contains non-salmonid Washington state priority level 3 fish species or is an irrigation canal that contains incidental resident salmonids. A sensitivity index of LOW is also applied to pipeline stream crossings occurring on non-fish bearing streams in locations where sedimentation from construction will affect a fish bearing stream; NO FISH (N)-no fish are present and sedimentation from construction will not affect a fish bearing stream.

(h) Riparian vegetation at stream crossing: for pipeline waterway crossings that involve invasive crossing methods - T (trees), S (shrubs), G (grass), U (unvegetated). For noninvasive crossings N (no or minimal riparian vegetation disturbance). Where no information was available from Dames & Moore (NR - not reported).

(i) DNR channel types - N/A indicates channels not classified by DNR (i.e., canals, wetlands, avoided). NR for no channel type reported by Dames & Moore.

(j) Crossing types: HDD - Horizontal Directional Drill; F - Flume; D - Divert; DRY - Dry Trench; WET - Wet Trench; B - Bore; BRIDGE - Bridge; OC - Over Culvert; UC -Under Culvert.

BLM = U.S. Bureau of Land Management administered federal lands.
BOR = U.S. Bureau of Reclamation administered federal lands.
DOD = U.S. Department of Defense (Yakima Training Center) administered federal lands.
USFS = U.S. Forest Service administered federal lands.
USFWS = U.S. Fish and Wildlife Service administered federal lands.

Appendix E. Evaluation of Micrositing Options and Alternative Routes

This appendix has been compiled based on information from the Application for Site Certification (ASC) (OPL 1998).

PIPELINE MICROSITING OPTIONS

The ASC map atlas prepared in February 1996 presented a proposed centerline based on known issues at that time. Since then, a number of route changes within the proposed corridor were made by OPL based upon findings from additional field studies and after consultations with federal, state, and local agencies and property owners. Micrositing refers to specific alignment changes made along the proposed centerline. Some of the changes and alternatives that were considered for the placement of the centerline are described below by approximate mile post increments. Micrositing of the pipeline will continue to occur to avoid problems or minimize impacts, with further consultation with landowners and agencies. Thus, not all changes in the route as a result of micrositing are presented below.

The criteria used for evaluating optional centerline locations included:

- Preference for use of existing cleared rights-of-way, including transmission line corridors, trails, and roadways.
- Avoidance of high quality wetlands or wildlife habitat.
- Minimizing impacts at stream crossings by the use of existing bridges.
- Minimizing impacts at stream or river crossings by using the narrowest feasible crossing points.
- Avoidance of land use impacts, such as to existing structures, irrigated crop lands, gardens, orchards, and golf course fairways.
- Considering landowner preferences as to line location.

MP 0 - 3.3

West of Maltby Road, there is an existing wetland. The alternatives to avoiding this wetland would have caused impacts to residential structures in Halo Estates. A route selection was made both to avoid the residential area and to trench through slightly less of the wetland area.

The wetland at Little Bear Creek would be crossed by the pipeline. There were no alternatives to route placement due to topography and the desire to stay within the existing BPA transmission line corridor. A decision was made in 1997 to cross the wetland using a horizontal directional drill to avoid direct impacts to the wetland; however, OPL revised that decision and decided to open cut with diversion because of the environmental damage that would be caused in order to clear space for the horizontal directional drill on both sides of the wetland and creek.

East of State Route 9, the proposed centerline was moved from the south side of the BPA right-of-way to the north side to minimize wetland impacts.

Between station 137.5 and 147.5 the route was moved to the north side of the powerline to accommodate the landowner's development.

MP 3.03 - 5.97

Between station 230 and 237, the centerline was moved to the north side of the corridor to minimize wetland impacts.

Echo Lake Road Wetlands (MP 4.5)

The preferred corridor is within the BPA right-of-way. The initial route crossed from the south side of the BPA right-of-way to the north side to avoid residences adjacent to the south side of the right-of-way. While the route avoided the homes, the route would have crossed an open water portion of a wetland. After a more thorough investigation, OPL decided to maintain the proposed corridor on the south side of the BPA right-of-way within a dirt access road, and then to cross to the north side of the right-of-way to avoid the homes. The proposed corridor avoids the more sensitive open water portion of the wetlands, but it is anticipated that there would still be some impacts to less sensitive portions of the wetland from construction of the pipeline.

The route then crosses the Echo Lake Golf Course. The centerline was rerouted to follow the existing golf cart path to minimize impacts to the golf course and to avoid wetlands.

MP 5.97 - 8.90

Near Welch Road, between about station 320 and 326, the centerline was moved slightly to accommodate the landowner's desires.

At about station 410, there were three alternatives to crossing the Snoqualmie River: to use the new Snohomish County Snoqualmie River Bridge, to dredge across the river, or to drill across the river. The preferred crossing method was to use the bridge, provided that there would be room in the utility corridor under the bridge at the time this project was permitted. The revised route would cross two small low-value wetlands on the west side. The bridge crossing would avoid drilling or dredging through the river and avoid construction staging in floodplains.

MP 8.90 - 14

At station 557 near Peoples Creek, the centerline was rerouted from the north side of the corridor to the south side to minimize impacts to the creek. At station 596, the centerline was rerouted outside of the BPA corridor to use an existing road and to cross the creek at a location where it is already in a culvert.

Between stations 683 and 694, the centerline was rerouted onto an existing road to avoid a wetland. At the King County line at station 725, the centerline was rerouted to the west to accommodate the landowner. There were no wetland impacts caused by the reroute.

North Road Wetlands (MP 12.8 to 13.0)

The initially-considered corridor and the preferred pipeline corridor are within the BPA corridor. The initial route would have crossed through a large wetland and open-water area extending across the right-of-way. The first alternative to crossing this wetland/open-water area was to go around it on the west side through private roads. Further investigation of this route concluded that there would still be potential impacts to wetlands and numerous residential yards. It was determined that a route around the east side of the wetland/open-water area was more feasible with fewer impacts to the wetland and residential properties.

MP 11.58 - 20.64

Between station 822 and 837, the centerline was moved from the east side of the BPA corridor to minimize impacts to wetlands. Between station 873 and 877, the centerline was rerouted to the east to decrease wetland impacts.

MP 20.64 - 25.19

At the Tolt River, the centerline was moved farther to the west to cross the mainstem through the riprap along the northern, or right, bank, in an area that was previously disturbed. The route was also revised to avoid a newly-constructed house.

MP 25.19 - 30.40

At Griffin Creek, the centerline was moved west of the BPA corridor to avoid a mature spruce tree.

MP 30.40 - 39.02

At Tokul Creek, the line was relocated to intersect Tokul Road north of the creek and crossed it on the bridge. The line lies longitudinally in Tokul Road, SE 53rd Way, and 396th Avenue SE until it joins an old railroad corridor north of Renig Road and follows it to the southeast side of North Bend. By using the abandoned railroad bed, mature trees were avoided.

Tokul Creek (MP 30.6 to MP 32.9)

Crossing of Tokul Creek created significant engineering difficulties due to the extremely steep slopes. The original route selected crossed Tokul Creek further to the east, and would have required clearing a construction corridor through approximately 0.5 miles of forested area. The initial route would have also impacted some wetland areas, and would have required a significant drop and rise in elevation. Two other potential routes were investigated, but both had similar constraints. After discussions with the commercial property owner, it was decided that the route following Falls Station Road (396th) would be more environmentally suitable.

MP 39.02 - 41.38

There were two alternative routings in this area, one using Edgewick Road. Edgewick Road is a heavily traveled two-lane paved road. During construction the road would have to be closed to through traffic; therefore, a route was selected to avoid the roadway impacts and to avoid the adjacent Category 1 forested wetland. The route at station 2115 was moved to the south to avoid Boxley Creek. At station 2155, the centerline was moved to accommodate the landowner and moved slightly onto Twin Falls State Park land.

Edgewick Road Wetlands (MP 38.6 To MP 41.2)

This area has numerous wetlands and small ponds. Many alternative routes were investigated to cross this area to reach the John Wayne Trail. The selected corridor had the least impacts of the routes investigated.

MP 41.38 - 47.44

At stations 2303 and 2314, the route was moved to the south side of the streams to improve constructability.

MP 47.44 - 53.50

In the vicinity of Alice Creek and Tinkham Road, the route was located to maximize the use of the road and previously disturbed areas, and to avoid impacts to the recreational trail. The centerline was also moved to avoid potential spotted owl habitat.

MP 53.50 - 66.57

At station 2860 to 2900, the centerline was moved from the John Wayne Trail to an abandoned railroad siding to minimize recreational impacts to trail users and to use previously disturbed lands. The centerline was also moved to use the narrowest crossing points for Humpback and Olallie Creeks to minimize impacts to the creek.

MP 66.57 - 69.60

At approximately MP 68, the centerline was rerouted around the existing tunnel due to limited construction space within the tunnel.

MP 69.60 - 72.54

At Cabin Creek (station 3820), consideration was given to using the existing bridge. The bridge was found to be unusable for the pipeline, and the centerline was rerouted to use a Puget Sound Energy maintenance road. The road was elevated away from most of the wetlands. This route would minimize wetland impacts and avoid mature trees.

MP 72.54 - 75.47

At station 3845, the centerline was routed onto Monahan Road to access the Puget Sound Energy transmission line corridor. At station 3935, the centerline was rerouted around a wetland that was found in the powerline corridor.

MP 75.47 - 78.41

At station 4057 - 4077, the centerline was realigned to cross the concrete-lined canal at a 90° angle. From station 4113 - 4120, the centerline was moved onto an existing road to avoid a wetland.

MP 78.41 - 81.25

At Big Bear Creek (MP 79), the centerline was moved to the west to accommodate a landowner. At Little Creek (station 4250 - 4058), the centerline was moved to the east to minimize impacts to the creek.

MP 81.25 - 82.95

At MP 82, there were two alternative alignments. One alignment would be in a spotted owl circle. An agreement was reached with a nearby landowner to cross onto the landowner's property to avoid the spotted owl circle.

MP 82.95 - 91.87

Between station 4382 - 4417, he centerline was moved to the north onto the powerline corridor to avoid a spotted owl circle, and then to the south edge of the BPA corridor to avoid wetlands. At station 4435 - 4445, the centerline was moved to the north onto an existing road to avoid a wetland. At station 4467 - 4478, the centerline was moved to the south to use an existing road and culvert crossing to avoid wetlands and Spex Art Creek.

MP 91.87 - 94.79

At station 5000, the route would cross the Yakima River. The centerline was moved to the north at the river crossing to avoid cottonwood trees. Consideration was given to building a bridge across the river at this location to extend the John Wayne Trail and to provide access to the Wallace Ranch, but a decision was made not to construct a bridge because of engineering constraints and costs. The alternative is under discussion with both State Parks and the landowner.

MP 94.79 - 106.91

At station 5097 - 5210, the centerline was moved off of the powerline to avoid wetlands, oak woodlands, and talus slope areas.

Swauk Creek (MP 97.5)

The preferred route followed the BPA corridor. Several important habitat features were identified in this area and the routes were further constrained by the Swauk Creek Canyon, which had very steep slopes with rock outcroppings. Field investigations determined that a more southerly route down the canyon slopes and then northerly back up the eastern side of the canyon was the most

feasible and would avoid impacts to the oak woodland habitat features. Although the preferred corridor passed through small areas of oak woodland, no oak trees would be removed.

MP 106.91 - 108.90

From station 5675 - 5742, the centerline was moved to the north and east to minimize impacts to wetlands and Currier Creek.

Ellensburg (MP 105.5 to MP 119)

The initial route would have brought the pipeline closer to Ellensburg with a terminal and pump station constructed on the northeast side of the Ellensburg Airport. Further investigation of this route and site for the terminal identified a number of issues: a significant number of wetlands would have been impacted; traffic patterns to the proposed terminal were difficult; and the pipeline would have been constructed on the John Wayne Trail through the City of Ellensburg. To avoid these impacts, the preferred corridor was significantly rerouted to traverse further north of Ellensburg, and the proposed terminal site was moved to near Kittitas. The preferred corridor minimized the wetland impacts and improved truck access to the terminal.

MP 108.90 - 115.91

From about MP 109 to MP 115, the centerline was relocated to the property lines to accommodate the landowners and to accommodate future development of the land.

MP 115.91 - 121.88

From station 6245, where the pipeline crossed under the Kittitas Highway, to station 6320, the centerline was moved to the west and south to accommodate the landowner. At station 6350 - 6410 the line was moved to the north to parallel the John Wayne Trail to avoid a sewage lagoon. The route then followed an existing road to the south to the Kittitas Terminal.

MP 121.88 - 124.91

From station 6444 - 6565, the centerline was moved off of the John Wayne Trail to parallel I-90 to accommodate landowner concerns. The realignment decreased impacts to private irrigation canals and lessened impacts on farming.

MP 124.91 - 127.94

From station 6572 to 6610, the centerline was moved to the north to avoid a gravel pit. Use of the railroad right-of-way was considered as an alternative route, but it was found to be too narrow to accommodate construction. From station 6727 - 6755, the centerline was also moved to the north to improve constructability.

MP 127.94 - 146.02

See Chapters 2 and 3 of the EIS for discussion of the options for crossing the Yakima Training Center, owned by the U.S. Department of the Army, or avoiding the training center by routing the pipeline north of I-90.

At Johnson Creek, the original route was moved further to the west to minimize wetland impacts.

MP 146.02 - 156.53

See Chapters 2 and 3 of the EIS for discussion of the options for crossing the Columbia River.

MP 156.53 - 161.46

Between station 8270 and 8365, two alternative routes were considered. The shortest route would traverse the land diagonally. The alternative route required that the pipeline go due north for 1 mile before turning east. The longer route was selected because there would be fewer wetland impacts.

MP 161.46 - 170.45

Between station 8605 - 8657, the centerline was moved farther to the north to avoid wetlands and at the landowner's request (Quack, Inc.) to avoid duck hunting areas. Between stations 8700 - 8810, the centerline was rerouted to follow a section line and moved to the north paralleling a railroad line to avoid wetlands that were important to waterfowl.

MP 170.45 - 173.30

At station 9147, the centerline was moved to the north side of State Route 26 to avoid the Columbia National Wildlife Refuge and wetlands.

MP 173.30 - 188.92

The original route crossed the toe and eastern portion of the Corfu Landslide area of the Saddle Mountains. An alternative was developed to parallel State Route 26 to Danielson Road. This alternative route would avoid the Corfu Landslide area, be shorter in length, and decrease wetland impacts by approximately 1.5 acres. At MP 182, the route would be located within the existing county road right-of-way.

Saddle Mountain (MP 177.7 to MP 184)

The initial corridor followed a transmission line that was approximately midslope on the Saddle Mountains (elevation approximately 1,300 feet). The geologic review indicated that this route traversed geologic formations similar to what was identified as the Corfu Landslide (MP 175 to MP 178). Although the Corfu Landslide is historic, it was decided to relocate the pipeline corridor to the toe of the slope along Kuhn Road to avoid crossing the potential landslide area.

MP 188.92 - 196.88

The proposed route in this location would run through a wetland. Alternatives were explored to avoid the wetland, but the route was constrained on the east by an existing irrigation circle. The irrigation pivot has electrical lines throughout the field and drainage tiles.

MP 196.88 - 202.94

At station 10455 - 10500, the centerline was zigzagged to minimize impacts to the Eagle Lakes wetlands. At station 10635 - 10645, the centerline was moved further east of Glade North Road to avoid a wetland and to cross the abandoned railroad bed at a 90° angle.

MP 202.94 - 205.97

At station 10735 - 10822, the centerline was moved to the east side of the right-of-way to improve constructability and to accommodate the landowner.

MP 205.97 - 208.99

At station 10945, the centerline was moved to the east side of Glade North Road to avoid an asparagus field and to accommodate landowner concerns.

MP 208.99 - 217.99

At station 11095, the centerline was moved to the edge of an irrigation sprinkler circle, which was not there at the time the route was originally planned. The relocated centerline then followed the property line.

MP 217.99 - 227.27

At stations 11614 - 11627, the centerline was moved to the south at Esquatzel Coulee to cross the coulee at a right angle and to avoid conflicts with the powerline.

MP 227.27 - 230.09

At station 12130, the centerline was rerouted to the north to follow an existing road into the Pasco Delivery Facility.

ALTERNATIVE PIPELINE ROUTE EVALUATION

Siting Criteria

A number of alternative pipeline routes were considered, including alternative origin points, alternative destination points, and alternative routes that would connect the desired origin and destination points. There are no federal, state, or industry criteria to be used in route selection for a petroleum product pipeline, but there are accepted practices within the pipeline industry. The following six criteria were used in evaluating route alternatives:

- length of pipeline as a cost factor for both construction and operation;
- elevation profile;
- constructability;
- pipeline access;
- environmental impacts; and
- ownership/land use.

A preliminary review of environmental impacts and pipeline access was conducted based on an aerial review by helicopter. If a route alternative was eliminated based on one of the first four criteria, it was considered either not buildable or not operable from a cost viewpoint. In those cases, a review of environmental impacts and ownership/land use impacts was not performed.

Pipeline Length. The cost of construction and operation of a pipeline is dependent upon its length. Increasing the length of a pipeline route directly increases the amount of materials and labor that must be utilized. There may also be a need to add more pump stations or to increase the diameter of the pipe in order to compensate for the additional frictional losses. Each of these items

adds to the pipeline's construction cost. If the size of the pipe is not enlarged, the increased length would result in the consumption of larger amounts of electric energy as a result of additional frictional losses. This adds to the pipeline's operation costs. The estimated effects of these elements are as follows:

- The estimated construction cost for a mile of pipeline is approximately $460,000.
- The estimated construction cost of each pump station is approximately $2 million.
- Enlarging the pipeline by one standard diameter costs approximately $32,000 per mile.
- Increasing the length while holding the diameter constant costs approximately $36,000 per mile-year.
- The estimated construction cost per additional river crossing is approximately $1 million.

Elevation Profile. The cost of construction and operation is also dependent upon the elevation profile of the route. Increasing the total elevation gain of a route or increasing the number of elevation gains and losses all result in an increase in the length of a pipeline's route and often cause an increase in the number of pump stations required, increasing the construction cost. High points and sudden elevation losses near the end of pipeline segments create the need to maintain higher-than-normal back pressures. This results in the consumption of larger amounts of electric energy and higher operating costs.

Constructability. Constructability refers to the engineering difficulty and construction costs relative to the topography and geology (soils) of a route. Steep and rugged terrain is more difficult to work with when engineering a pipeline, and costs of construction are significantly higher than constructing on more level terrain. The routes are also reviewed to identify any significant obstacles to construction. Large rock outcroppings, narrow right-of-way, water bodies, and steep slopes are among the construction obstacles that can add significant costs and present impassable or difficult barriers.

Areas that needed special construction techniques were also a consideration. Such areas included extensive construction through rock, water crossings including irrigation systems, agricultural fields that have drainage systems, narrow rights-of-way, and steep slopes.

Routes were analyzed using the following subcriteria:

- Did the route include steep and rugged terrain that would present an impassable or difficult barrier to construction equipment and personnel?
- Did the route include large rock outcroppings that would be a barrier to construction?
- Did the route include narrow right-of-way that would not provide adequate space for construction equipment and materials?

- Did the route cross major water bodies that would require specialized construction techniques?

Pipeline Access. Petroleum pipelines are designed to be in use for decades. When choosing right-of-way, prime consideration is given to pipeline access for maintenance activities. The pipeline corridor is chosen so that access to the line is very easy at valve and pump station locations and easy at all other points. Routes were analyzed using the following subcriteria:

- Did public roadways exist near the pipeline corridor?

- In an emergency situation, could emergency response personnel reach the pipeline from a public roadway within 1 hour?

- Did public roadways exist near the valve and pump station locations?

- Can access be gained to the sites from the nearest public roadways?

Environmental Impacts. Alternative routes are reviewed on a preliminary basis for significant environmental impacts and significant environmental impacts were avoided to the greatest extent possible. Consideration was given to wetlands, stream crossings, sensitive plant and animal species, and important habitats. Although many of the environmental resource impacts could not be avoided, the overall impact could be minimized. Selecting a route that included a high percentage of existing right-of-way could also minimize the overall significance of the impact to the environment. To minimize the disturbance of existing habitats and land uses, routes that would use existing cleared or disturbed rights-of-way were preferred. Routes were analyzed using the following subcriteria:

- How many miles of existing cleared or disturbed rights-of-way would the alternative route use?

- How many miles of new right-of-way would have to be cleared?

- How many major water crossings would be crossed by each alternative route?

- Did the alternative route cross any known highly sensitive plant and animal habitats?

Three planning principles were used to minimize or avoid environmental impacts. The first planning principle was to utilize areas that had been impacted previously and to avoid areas that have not been impacted previously. Previously impacted areas included:

- Rights-of-way for roads, rail-trails, electric power transmission lines, and other pipelines which were appropriate and otherwise compatible with the proposed pipeline.

- Parcels on which the plant communities and other features of the landscape had been significantly altered by logging, grazing, or cultivation.

The second planning principle was to avoid sensitive/critical areas to the maximum feasible extent. These areas included:

- old growth forest;
- priority plant and animal habitat;
- sub-alpine and alpine habitat;
- lakes
- streams
- wetlands
- highly erodible/unstable slopes; and
- historically/culturally significant sites.

Avoidance of impacts to these features occurred primarily by physically avoiding contact with the feature and any associated buffers.

The third planning principle was to minimize impacts to sensitive/critical areas when avoidance of those areas was not possible. Large wetlands or streams that extended across the width of the route were examples of aquatic features in this category.

- Where wetlands or streams could not be avoided, an alignment was selected that routed the pipeline through the narrowest and/or least sensitive portion of the feature.

Further impact reduction would be accomplished during construction by:

- narrowing the width of the construction corridor;

- minimizing riparian tree removal;

- having construction equipment work from beyond the boundary of the feature where feasible and from equipment mats elsewhere;

- using erosion/sediment control devices; and

- undertaking rapid stabilization and revegetation of disturbed areas.

In reviewing proposed water crossings, two questions were asked of each crossing location and proposed method:

- Were there practicable alternative locations for the pipeline alignment that would result in less impact to the aquatic ecosystem?

- Were there practicable alternative construction techniques that could be utilized at a given crossing location that would result in less impact to the aquatic ecosystem?

In general, because streams are long linear features, it was not possible for a pipeline alignment to avoid crossing them. The following subcriteria define the issues of concern with respect to stream crossings:

- Was there a nearby practicable location for the stream crossing that would result in decreased impacts to the streambed or riparian zone?
- Was there a nearby practicable location for the stream crossing that would result in decreased potential for erosion, sedimentation, or water quality degradation?
- Was there a nearby practicable location for the stream crossing that would enable a construction method to be used with fewer environmental impacts?

In contrast, wetlands tend to occupy a defined space with identifiable boundaries. It was theoretically possible for a pipeline to entirely avoid wetlands and the regulations require that to be done unless it could be demonstrated that it was not practicable to do so. The following subcriteria defined the issues of concern with respect to wetland crossings:

- Could the pipeline alignment be moved slightly (i.e., into an upland) to avoid the special aquatic site?
- If an upland alignment was available, had it been previously impacted?
- If an upland alignment was available, would its use result in the loss of any priority habitat or other sensitive habitat
- If an upland alignment was available, would its use result in indirect impacts to special aquatic sites such as loss of buffers, destabilization of adjacent banks/slopes, modification of hydrology, or degradation of water quality?
- If an upland alignment was available, would its use bring the pipeline alignment into proximity with structures used for residential, industrial, or public assembly purposes?
- If an upland was available, would its use result in the alignment being unacceptably close to other structures such as the base of electric transmission towers/poles, buried power or communication cables, or other buried utility lines such as those used to transport water, sewer, natural gas, and crude/refined petroleum?
- If an upland was available, would its use result in the alignment being in an area that was subject to disturbance by others performing routine construction/maintenance activities on roads or other utility facilities?
- If an upland was available, would its use result in the alignment being in an area that was likely to necessitate a relocation of the pipeline in the future?

- Was there a nearby location that would result in less total impact on special aquatic sites, taking into account size, plant community, and functions?

Ownership/Land Use. The overall cost and time to acquire rights-of-way for a proposed pipeline are significant considerations. Constructing a pipeline through highly developed areas is expensive and there are often significant landowner issues that have to be considered. Although these areas often cannot be avoided, construction through highly developed areas can be minimized by careful selection of a route. Minimizing the total number of landowners that are affected reduces the number of easements that have to be negotiated and the overall cost of the project. Selecting a route that traverses grazing and/or unproductive land, utilizing existing corridors, and using large tracts of land that are under single ownership are factors in evaluating potential routes. Routes were analyzed using the following subcriteria:

- Did the proposed route cross through populated areas?

- Did the proposed route cross through land in which the use of a pipeline would conflict with adjacent existing land uses?

- Would the proposed route cause the long-term loss of agricultural land?

Alternative Routes Evaluated

Based on an operating scenario of constructing a new product pipeline to Pasco, Washington, a number of alternative pipeline routes were identified following the three central mountain passes in Washington:

- Stevens Pass;
- Snoqualmie Pass; and
- Stampede Pass.

Maps of these mountain passes were reviewed to identify any existing road or utility corridors that could potentially be used for a pipeline. The alternative mountain pass routes which were considered, based on the Pasco Terminus Alternative, were:

- Allen Station via Stevens Pass to Pasco

- Snohomish via Stevens Pass to Pasco

- Thrashers Corner via Snoqualmie Pass to Pasco

- Thrashers Corner via abandoned railroad route (Centennial Trail) and Snoqualmie Pass to Pasco

- Hollywood via the Tolt Pipeline Corridor and Snoqualmie Pass to Pasco

- Renton Station via Stampede Pass to Pasco

In addition, there was one variation through the Yakima Valley to Pasco that could use any of the three mountain pass routes. The six route alternatives and one sub-alternative are described below and compared in Table E-1.

Allen Station Alternative via Stevens Pass. The Allen Station Alternative route would take advantage of the point where the two existing product lines first come together at the Allen Pump Station approximately 2.5 miles west of Burlington, Washington. From this point, a new pipeline would be constructed in the existing right-of-way to a point approximately 4 miles south of Everett where the existing pipelines cross the Burlington Northern Railroad (BNRR) tracks. At this point, a new pump station would be constructed and the route would turn east and parallel the BNRR right-of-way through the communities of Monroe, Sultan, and Gold Bar. Because the BNRR right-of-way narrows near the community of Index, the pipeline route would enter the BPA powerline right-of-way which also parallels U.S. Highway 2 to a point approximately 5 miles east of the Stevens Pass summit. At this location, the route would follow the old BNRR right-of-way to the abandoned Old Cascade Tunnel under Stevens Pass.

The route, after exiting the east portal of the Old Cascade Tunnel, would generally follow U.S. Highway 2 and BPA powerlines easterly approximately 24 miles to Chumstick Creek in the Wenatchee National Forest. The route turns south and parallels Chumstick Creek and a county road for approximately 8 miles to Leavenworth. At Leavenworth, the route would again generally follow existing BPA powerlines southeasterly for approximately 39 miles passing north of Cashmere, crossing the Wenatchee River east of Monitor and going west of Wenatchee.

South of Wenatchee, the route would follow BPA powerlines that parallel the Columbia River. The route would cross the Columbia River south of Rock Island Dam where a BPA powerline crosses the Columbia River west of Moses Coulee. After crossing the Columbia River, the route would traverse southeasterly through the Columbia Basin Irrigation Project and intersect State Route 26 east of the community of Royal City. This alternative would parallel State Route 26 to a point approximately 4 miles west of Othello, then turn south following county roads to Pasco along the same route as the Thrasher to Pasco route.

- **Pipeline Length:** The approximate length of the pipeline would be 285 miles.

- **Elevation Profile:** Eight (8) pump stations would be required.

- **Constructability:** Routes using Stevens Pass were considered more rugged with more steep slopes and rock outcroppings, and therefore less "constructable" than routes using Snoqualmie Pass.

- **Pipeline Access:** The terrain was considered more "remote" than routes using Snoqualmie Pass, and therefore less accessible.

Table E-1. Alternative Pipeline Route Evaluation Summary

Route	Pipeline Length (miles) and Cost (millions)	# of Pump Stations	Constructability	Pipeline Access	Environmental Impacts	Ownership/Land Use
Allen Station via Stevens Pass to Pasco	285 $133.0	8	less constructable than Snoqualmie Pass routes	difficult	4 river crossings: Columbia, Snohomish, Skykomish (6 times), Wenatchee	7 cities: Monroe, Sultan, Gold Bar, Index, Leavenworth, Cashmere, Wenatchee
Snohomish via Stevens Pass to Pasco	240 $125.0	7	less constructable than Snoqualmie Pass routes	difficult	4 river crossings: Columbia, Snohomish, Skykomish (6 times), Wenatchee	7 cities: Monroe, Sultan, Gold Bar, Index, Leavenworth, Cashmere, Wenatchee
Thrashers Corner via Snoqualmie Pass to Pasco	230 $105.1	6	more constructable than Stevens Pass routes	easy	4 river crossings: Snoqualmie (4 times), Tolt, Columbia, Yakima	3 cities: North Bend, Snoqualmie, Kittitas (North Bend and Snoqualmie on trail)
Thrashers Corner via abandoned railroad route (Centennial Trail) and Snoqualmie Pass to Pasco	245 $115.0	6	more constructable than Stevens Pass routes	moderate	4 river crossings: Snoqualmie (4 times), Tolt, Columbia, Yakima; Significant wetland impacts along Centennial Trail	7 cities: Duvall, Carnation, North Bend, Snoqualmie, Kittitas, Ellensburg, Beverly
Hollywood via the Tolt Pipeline Corridor and Snoqualmie Pass to Pasco	225 $109.0	8	more constructable than Stevens Pass routes	easy	4 river crossings: Snoqualmie, Tolt, Columbia, Yakima	3 cities: North Bend, Snoqualmie, Kittitas. Conflict with City of Seattle Tolt River Pipeline corridor
Renton Station via Stampede Pass to Pasco	210	8	less constructable than Snoqualmie Pass routes	moderate	4 river crossings: Cedar, Green, Columbia, Yakima	Densely populated south King County. Conflict with Seattle Cedar River and Tacoma Green River watersheds
Yakima Valley	240 $110.0	8	constructable assuming paired with Snoqualmie Pass route	easy	4 river crossings: Snoqualmie (4 times), Tolt, Columbia, Yakima (6 times). Construction impacts to vineyards, orchards, crops	4 cities: Ellensburg, Yakima, Selah, Richland. Land use conflicts due to construction impacts to vineyards, orchards, crops

- **Environmental Impacts:** There would be four major river crossings: Columbia, Snohomish, Skykomish, and Wenatchee Rivers, with at least six crossings of the Skykomish between Monroe and Index.

- **Ownership/Land Use:** Seven cities would be impacted: Monroe, Sultan, Gold Bar, Index, Leavenworth, Cashmere, and Wenatchee.

Snohomish Alternative via Stevens Pass. An alternative to the Allen Station Alternative would be to tie into the two existing pipelines at the crossing of the BNRR right-of-way south of Everett. From this location, the route would be the same as the Allen Station Alternative.

- **Pipeline Length:** The approximate length of the pipeline would be 240 miles.

- **Elevation Profile:** Seven (7) pump stations would be required.

- **Constructability:** Routes using Stevens Pass were considered more rugged with more steep slopes and rock outcroppings, and therefore less "constructable" than routes using Snoqualmie Pass.

- **Pipeline Access:** The terrain was considered more "remote" than routes using Snoqualmie Pass, and therefore less accessible.

- **Environmental Impacts:** There would be four major river crossings: Columbia, Snohomish, Skykomish, and Wenatchee Rivers, with at least six crossings of the Skykomish between Monroe and Index.

- **Ownership/Land Use:** Seven cities would be impacted: Monroe, Sultan, Gold Bar, Index, Leavenworth, Cashmere, and Wenatchee.

Thrashers Corner Alternative via Snoqualmie Pass. This is the proposed pipeline, as discussed in detail in Chapters 2 and 3 of the EIS and summarized below:

- **Pipeline Length:** The approximate length of the pipeline would be 230 miles.

- **Pipeline Hydraulics:** Six (6) pump stations would be required.

- **Constructability:** Routes using Snoqualmie Pass were considered less rugged than Stevens Pass routes with fewer steep slopes and rock outcroppings, and therefore more "constructable" than routes using Stevens Pass.

- **Pipeline Access:** The majority of the route follows existing roads, trails, and transmission line corridors. Where new right-of-way corridors would be needed, they were located near existing roads or utility corridors. Due to the proximity of I-90, the use of the Cedar Falls Trail and the John Wayne Trail, and many existing county and private roads, the route was considered very accessible.

- **Environmental Impacts:** Approximately 109 miles of the route would be in existing cleared rights-of-way. These would limit the need to disturb uncleared land and limit impacts on wetland and vegetation habitats. The route would cross 293 rivers, streams, or culverts; however 12 of these crossings would be on existing bridges and many of these crossings would be located above or below an existing culvert, or below an existing irrigation canal.

- **Ownership/Land Use:** Federal agencies own 25 miles of the route, state agencies own or control 30 miles, local agencies own or control 1.5 miles, and there are 175 miles in private ownership with many ownerships in large tracts. The pipeline would cross through three cities or towns (North Bend, Snoqualmie, and Kittitas), although the route through North Bend and Snoqualmie would be on the existing Cedar Falls Trail and would not require new right-of-way to be developed.

Thrashers Corner Alternative via the Centennial Trail and Snoqualmie Pass. This alternative would use the Centennial Trail (an abandoned railroad right-of-way) that follows the Snoqualmie River valley. This alternative would begin at Thrashers Corner and head east along the existing BPA powerline corridor. However, after crossing the Snoqualmie River, the alternative route would utilize the railroad right-of-way that generally parallels State Route 203 on the east side of the Snoqualmie River valley. The route would remain on the old railroad right-of-way over Snoqualmie Pass, the Columbia River, and to a point just east of Royal City where it would turn south to Pasco following the same route as described above for the Thrashers Corner to Pasco route.

- **Pipeline Length:** The approximate length of the pipeline would be 245 miles.

- **Elevation Profile:** Six (6) pump stations would be required.

- **Constructability:** The existing right-of-way in the Snoqualmie Valley is very narrow and would cause a considerable increase in the construction time due to the difficulties of moving labor and equipment in a confined space.

- **Pipeline Access:** The majority of the route would follow an abandoned railroad line. In some places, this route would parallel existing highways or roads. However in the vicinity of Snoqualmie Pass, the route would be farther from I-90 and other existing roads than the Thrashers Corner to Pasco route. It was therefore considered less accessible.

- **Environmental Impacts:** Approximately 115 miles of the route would be in existing cleared rights-of-ways. While this would generally limit the need to disturb uncleared land and limit impacts on wetland and vegetation habitats, there were a number of wetlands directly adjacent to the Centennial Trail. Due to the narrowness of the trail, it would be very difficult if not impossible to avoid temporary construction impacts to the wetlands. In addition, the trail bed would require widening to allow space for the pipeline in addition to the existing cable, and this widening would require filling of wetlands on one or both sides of the trail.

- **Ownership/Land Use:** Federal agencies own 10 miles of the route, state agencies own or control 33 miles, local agencies own or control 7 miles, and there are 87 miles in private ownership. The pipeline would cross through seven cities or towns (Duvall, Carnation, North Bend, Snoqualmie, Kittitas, Ellensburg, and Beverly), although the route through would be on the existing Centennial Trail and would not require development of new right-of-way.

Hollywood-Tolt Pipeline Alternative via the Tolt Pipeline Corridor and Snoqualmie Pass. The Hollywood-Tolt Pipeline Alternative would originate near Hollywood in the Sammamish River valley and would head directly east following the right-of-way of the City of Seattle's Tolt River Waterline. This route would cross the Snoqualmie River south of Duvall and connect with the BPA powerline corridor north of Stillwater. At this point the route would follow the Thrasher-Pasco corridor over Snoqualmie Pass to Pasco.

Although this route is a cleared pipeline route and would have fewer direct landowner and environmental impacts, the City of Seattle has plans to develop an additional water pipeline within their corridor. Concerns have been expressed by the City of Seattle over placing a petroleum products pipeline in the same right-of-way as the water pipeline that supplies potable water to the City of Seattle.

- **Pipeline Length:** The approximate length of the pipeline would be 225 miles.

- **Elevation profile:** Eight (8) pump stations would be required.

- **Constructability:** Routes using Snoqualmie Pass were considered less rugged than Stevens Pass routes with fewer steep slopes and rock outcroppings, and therefore more "constructable" than routes using Stevens Pass.

- **Pipeline Access:** The majority of the route follows existing utility corridors, roads, trails, and transmission line corridors. Where new right-of-way corridors were needed, they were located near existing roads or utility corridors. Due to the proximity of I-90, the use of the Cedar Falls Trail and the John Wayne Trail, and many existing county and private roads, the route was considered very accessible.

- **Environmental Impacts:** Four rivers would be crossed: Snoqualmie, Tolt, Columbia, and Yakima.

- **Ownership/Land Use:** The Tolt River Pipeline corridor is owned by the City of Seattle, which has plans to place a second water pipeline in the corridor, eliminating space for a petroleum products pipeline.

Renton Station Alternative via Stampede Pass. One route was considered over Stampede Pass, starting near I-405 and State Route 167 at the existing OPL Renton Station. The Renton Station, in addition to being a pump station, is also the main office and monitoring station for OPL. The route would go northeasterly out of the Renton Station to State Route 169 (Maple Valley Road). The route would use the existing powerline and railroad right-of-way and traverse

southeasterly paralleling State Route 169. Near 192nd Street the route would turn east, crossing State Route 18 just north of Hobart and connect with the BPA powerline corridor. The route would then generally follow the existing powerline right-of-way southeasterly past Howard Hanson Reservoir, then northeasterly ascending Stampede Pass. The route would then turn to the southeast and connect with the John Wayne Trail and follow the same route as the Thrasher-Pasco corridor.

- **Pipeline Length:** The approximate length of the pipeline would be 210 miles.

- **Elevation Profile:** Eight (8) pump stations would be required.

- **Constructability:** Routes using Stampede Pass were considered more rugged than Snoqualmie Pass routes with more steep slopes and rock outcroppings, and therefore less "constructable" than routes using Snoqualmie Pass.

- **Pipeline Access:** Because Stampede Pass was more remote in places, the access to the pipeline in mountainous areas was considered less accessible than routes over Snoqualmie Pass.

- **Environmental Impacts:** The route would pass through both the Cedar River and Green River watersheds. There were strict prohibitions on construction within watershed areas.

- **Ownership/Land Use:** The route would pass through more densely populated areas in south King County and was viewed to have greater ownership and land use impacts than routes using Snoqualmie Pass.

Yakima Valley Alternative from Stevens, Snoqualmie, or Stampede Passes. An alternative route to Pasco was considered that would turn south near Ellensburg and go through the Yakima Valley. The Yakima Valley Alternative would have used any of the three alternative routes over Stevens Pass, Snoqualmie Pass, or Stampede Pass. East of Snoqualmie Pass, all of the considered routes would follow the existing BPA powerlines going south and east of Cle Elum. East of Cle Elum, where the powerline corridor crosses the Yakima River, the routes would also cross the John Wayne Trail. The Yakima Valley Alternative would follow the trail and cross over the Yakima River several times on existing railroad bridges. West of Ellensburg, the route would turn south, crossing the Yakima River several times, and would generally parallel the west side of the Yakima River.

Approximately 5 miles south of Ellensburg, the route would cross to the east side of the Yakima River and follow the railroad right-of-way. The corridor through the canyon would cross the Yakima River a minimum of five times north of Yakima, then the route would turn southeasterly and follow an existing BPA powerline right-of-way that is north of the Roza Canal. Near the Yakima/Benton County line and State Route 241, the route would turn south along an existing powerline corridor. Approximately 6 miles north of Grandview, the route would turn east and southeast crossing the Columbia River on the Interstate 182 bridge and going north of Pasco before turning south to the Pasco Delivery Facility.

- **Pipeline Length:** The approximate length of the pipeline would be 240 miles.

- **Pipeline Hydraulics:** Eight (8) pump stations would be required.

- **Constructability:** The Yakima Valley Alternative could use any of the three mountain pass routes. It was considered "less constructable" because it would have crossed the Yakima River a minimum of six times (at approximately $0.75 to 1 million for each crossing) and would have crossed irrigation canals 43 times, including 2 crossings each of the Sunnyside and Rosa Canals.

- **Pipeline Access:** With the Snoqualmie Pass crossing, this route would be as accessible as the proposed Thrasher to Pasco Alternative.

- **Environmental Impacts:** The route would cross the Yakima River a minimum of six times. The route would cross a number of vineyards, croplands, and orchards. The route would cross the Sunnyside and Rosa Irrigation Canals twice. The route would cross irrigation canals 43 times.

- **Ownership/Land Use:** The route would pass through the densely populated areas of Ellensburg, Yakima, Selah, and Richland. Construction impacts to vineyards, orchards, and croplands such as those used for growing asparagus would be significant.

Summary of Route Alternatives

A comparison of the six route alternatives and one sub-alternative is shown in Table F-1.

The routes were compared first for pipeline length because the length adds significantly to both the construction and operation costs. The construction cost for the pipeline through generally level terrain is approximately $460,000 per mile. The Allen Station via Stevens Pass Alternative would be 45 to 60 miles longer than other routes and would therefore cost a minimum of between $20 and $28 million more to build than other routes. This route and the Snohomish Alternative would both go over Stevens Pass. Stevens Pass is much more rugged, with more steep slopes and more rock outcroppings than Snoqualmie Pass. These factors add to the construction difficulty, and would significantly increase construction costs and the time required for construction in mountainous areas. Both routes would also require going through seven cities with construction impacts to both residents and motorists on U.S. Highway 2. For these reasons, both the Allen Station and Snohomish Alternatives were eliminated from further consideration.

The Renton Station Alternative would use Stampede Pass, and would go through the City of Seattle's Cedar River watershed and the Green River watershed. Stampede Pass was judged to be less constructable than Snoqualmie Pass alternatives, the pipeline access would be more remote than Snoqualmie Pass alternatives, and it was unlikely that permission would be granted by the City of Seattle to construct within the Cedar River watershed. For these reasons, this alternative was eliminated from further consideration.

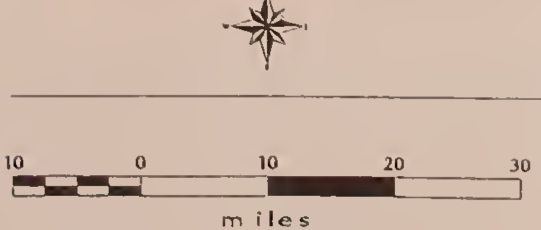
Three alternatives using Snoqualmie Pass were considered. One route using the Centennial Trail would be approximately 20 miles longer than the other two at an approximate increase of $10 million in construction costs. The Hollywood Alternative would require two additional pump stations, at a construction cost of approximately $4 million over the Thrashers Corner Alternative. Pipeline access would range from easy to moderate for all three alternatives. All three would have the same number of river crossings. A preliminary review of wetland impacts for the three alternatives showed that the alternative using the abandoned railroad line along the Centennial Trail would create the unavoidable impact of filling high quality wetlands. High quality wetlands could be avoided on the other two Snoqualmie Pass alternatives. The railroad alternative also would impact a greater number of cities than the other two Snoqualmie Pass alternatives. Due to the need to add fill to widen the Centennial Trail route, the resulting unavoidable impacts to wetlands, and the greater number of cities that would be affected during construction, the railroad alternative was eliminated from further consideration.

Of the two remaining Snoqualmie Pass alternatives, the Hollywood Alternative would place the proposed pipeline in the City of Seattle Tolt River Water Pipeline corridor. The city has initiated plans to add a second water pipeline within this corridor, and there would not be room for two water pipelines plus the refined petroleum products pipeline. Because this route would now require the clearing of new right-of-way, it was eliminated from further consideration.

The Yakima Valley Alternative could be used with any of the three mountain pass crossings. The environmental impacts were judged to be greater than the Thrashers Corner Alternative because the Yakima Valley Alternative would require crossing the Yakima River a minimum of six times as compared to one crossing for the Thrashers Corner Alternative. The increase in crossings would increase construction costs by approximately $5 million (river crossing costs are estimated at $1 million per crossing). The route would also cross through vineyards, orchards and crops such as asparagus. The Thrashers Corner Alternative would cross primarily through grazing land and would skirt irrigated fields. The Yakima Valley Alternative was judged to have a greater impact on land uses for this reason. The purchase cost of right-of-way easements from property owners was also estimated to be greater due to the impacts to vineyards, crop lands, and orchards. The construction impacts to these areas would take longer to recover than the brief impacts to open grazing land. For these reasons, the Yakima Valley Alternative was eliminated from further consideration.

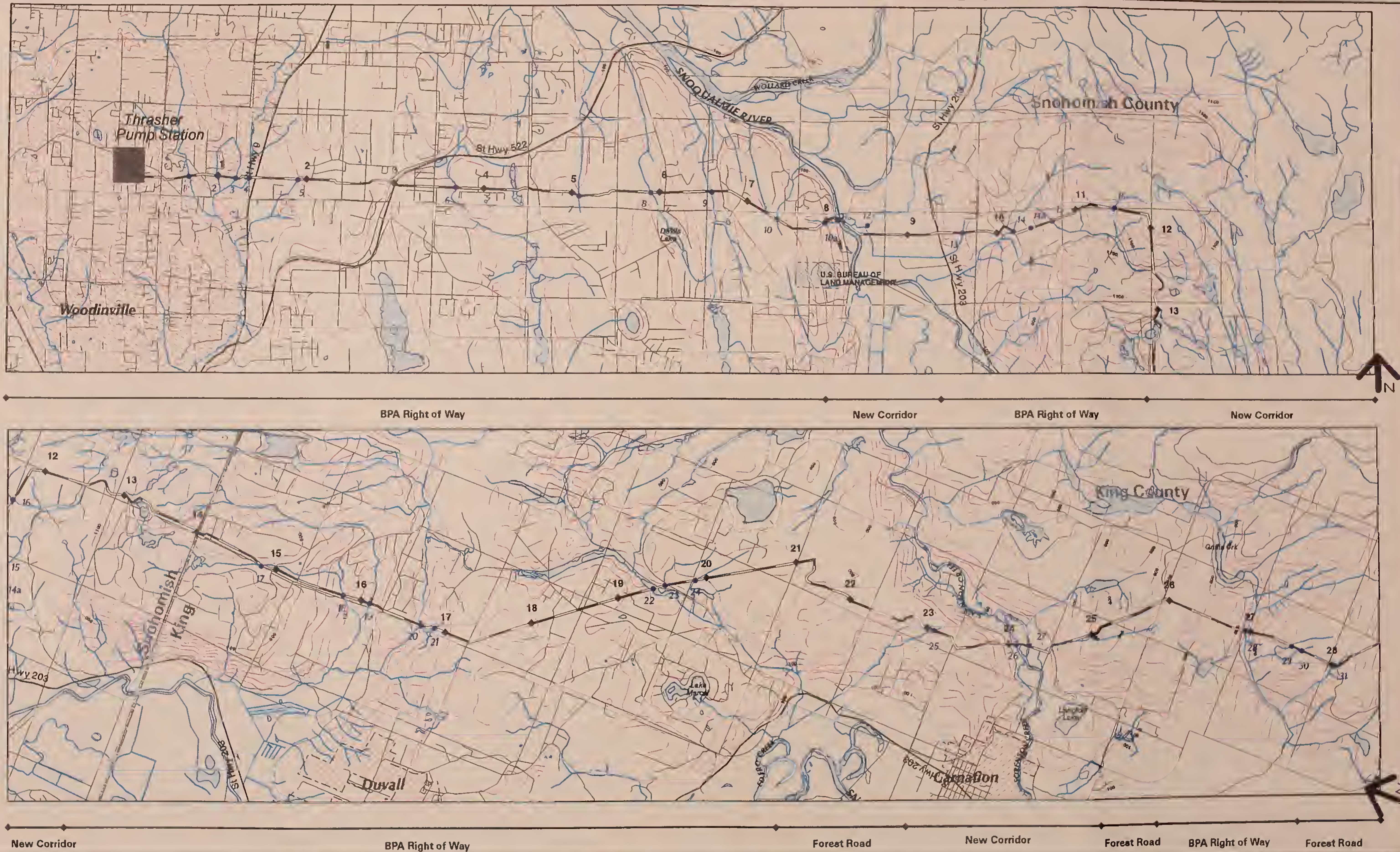
The remaining alternative, Thrashers Corner via Snoqualmie Pass to Pasco, was found to be constructable and accessible. The alternative made extensive use of existing utility or road corridors to minimize the need to clear new right-of-way. The route avoids crossing through major populated areas, and crosses through two cities (Snoqualmie and North Bend) within an existing trail.

EIS Map Supplement



INDEX TO STRIP MAPS OF PIPELINE ROUTE

Cross Cascade Pipeline
Washington



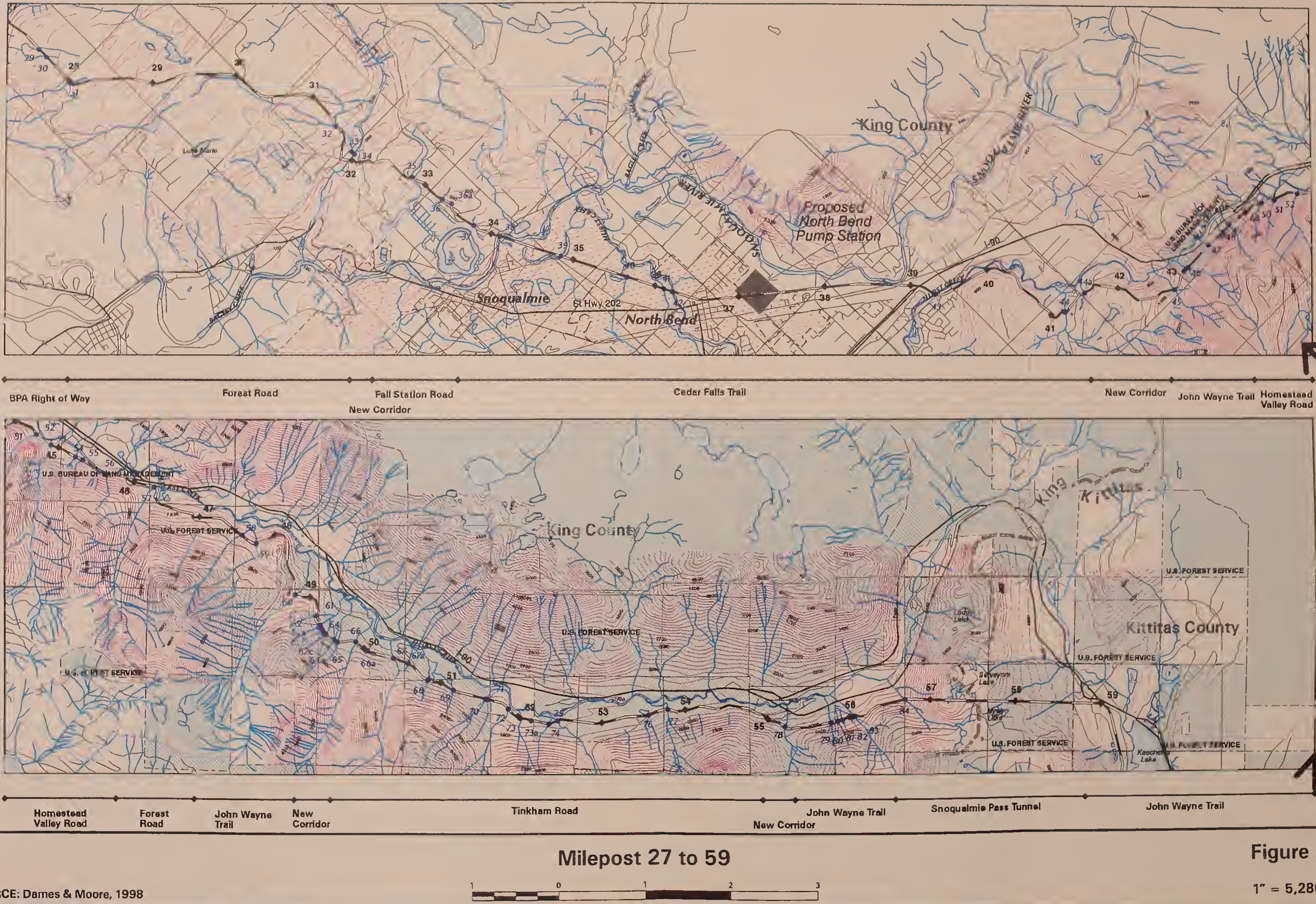
Milepost 1 to 28

Figure 1

1" = 5,280'

miles

SOURCE: Dames & Moore, 1998

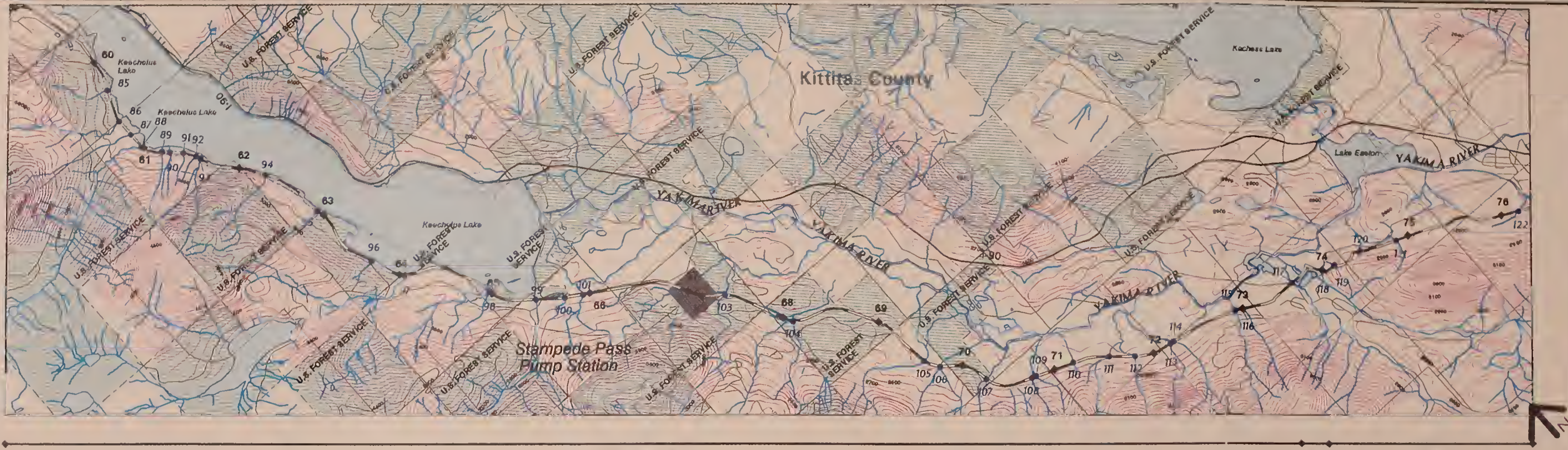


Milepost 27 to 59

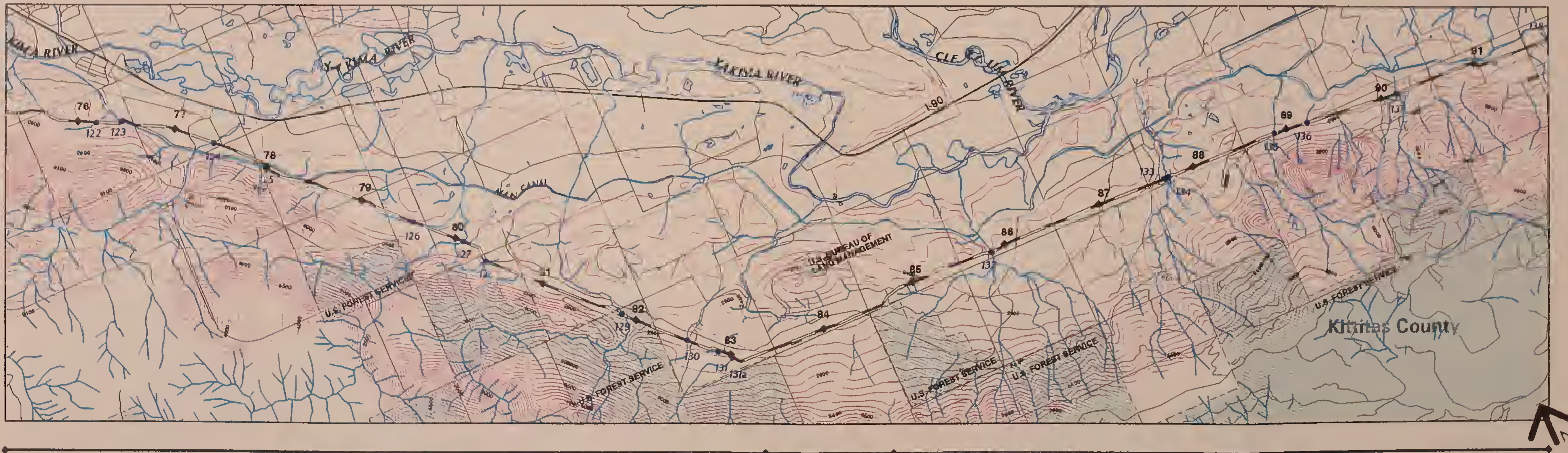
Figure 2

1" = 5,280'

SOURCE: Dames & Moore, 1998



John Wayne Trail — Monahan Road — BPA Right of Way



BPA Right of Way — New Corridor — BPA Right of Way

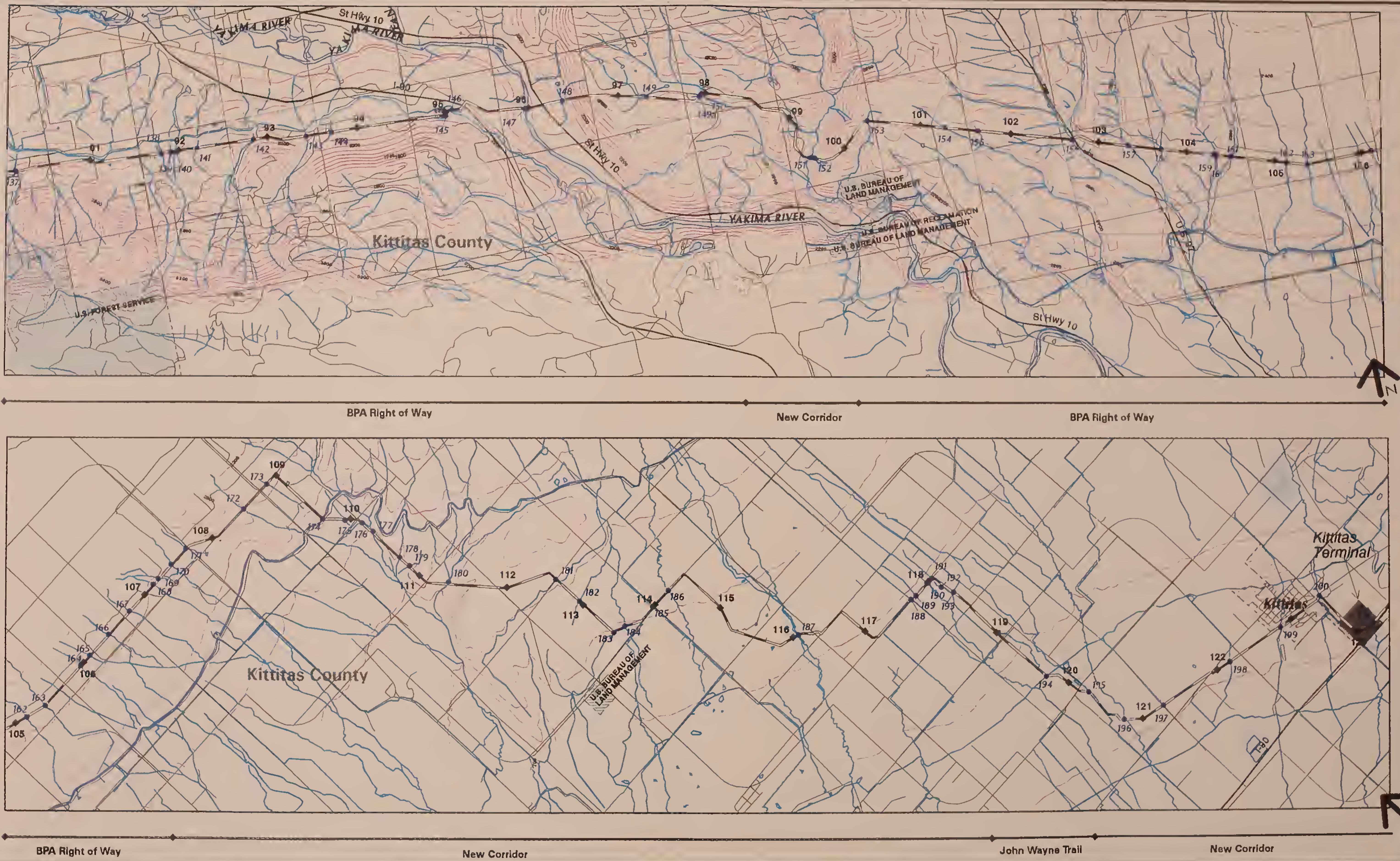
Milepost 59 to 91

Figure 3

1" = 5,280'

miles

SOURCE: Dames & Moore, 1998



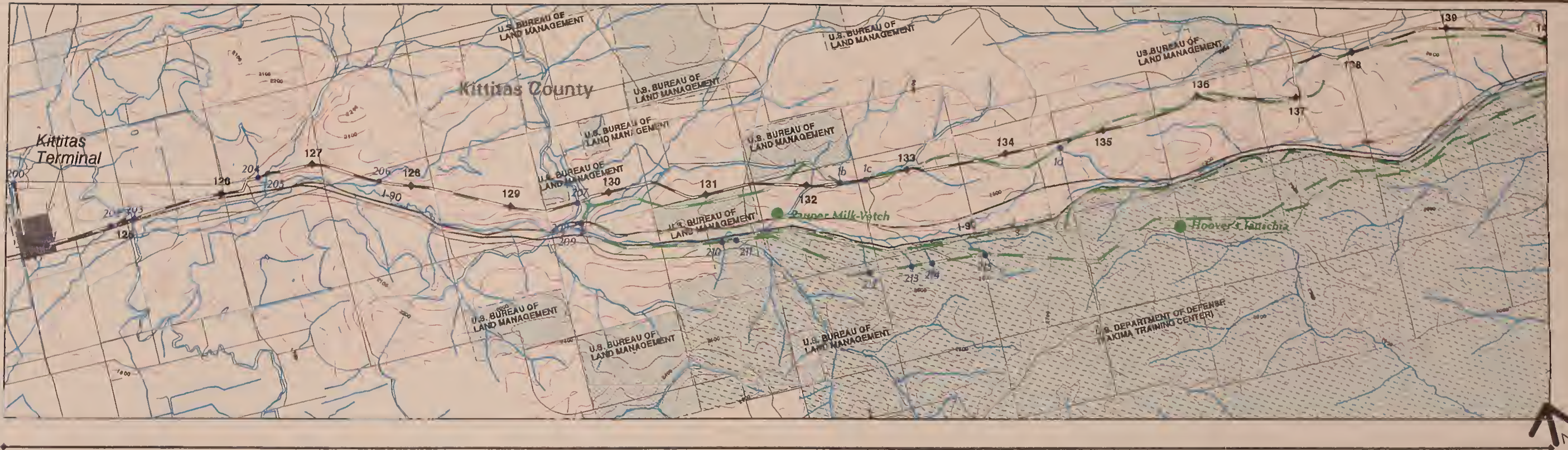
Milepost 91 to 124

Figure 4

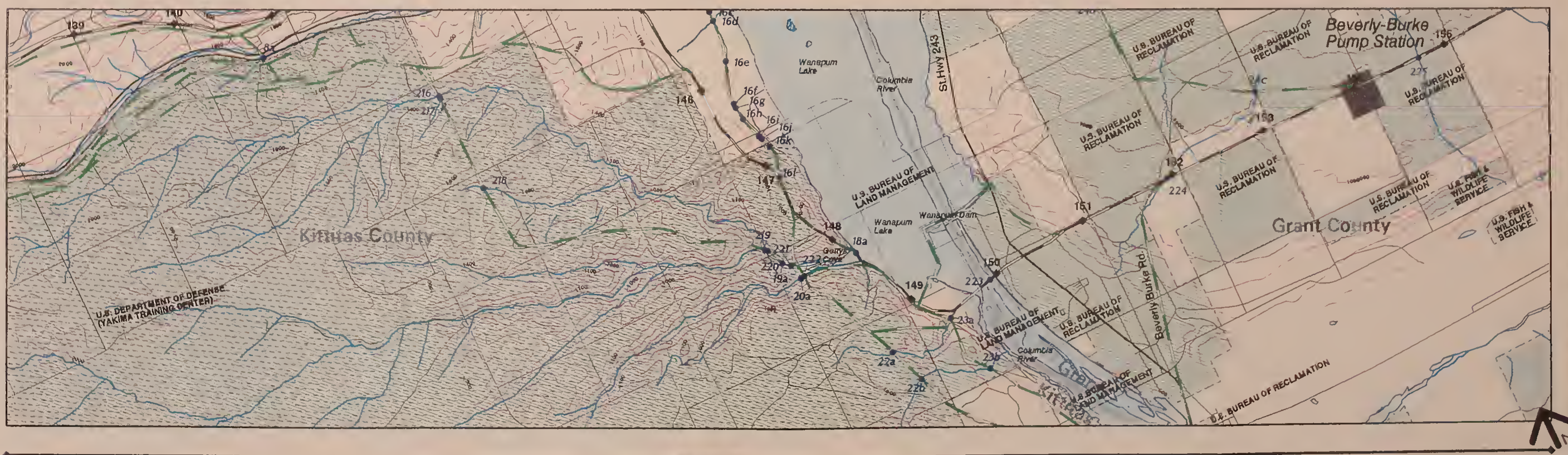
SOURCE: Dames & Moore, 1998

1 0 1 2 3
miles

1" = 5,280'



New Corridor



New Corridor

Milepost 124 to 155

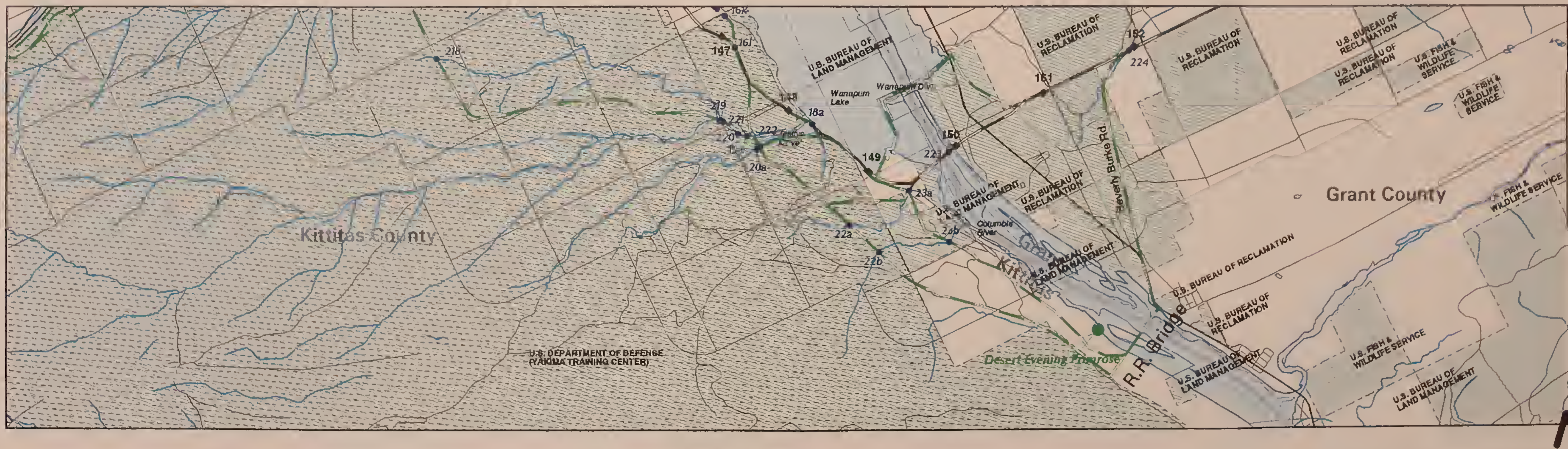
Figure 5

1" = 5,280'

miles

SOURCE: Dames & Moore, 1998

New Corridor



New Corridor

SOURCE: Dames & Moore, 1998

Milepost 139 to 152

1 0 1 2 3
miles

Figure 6

1" = 5,280'

SOU

Milepost 155 to 185

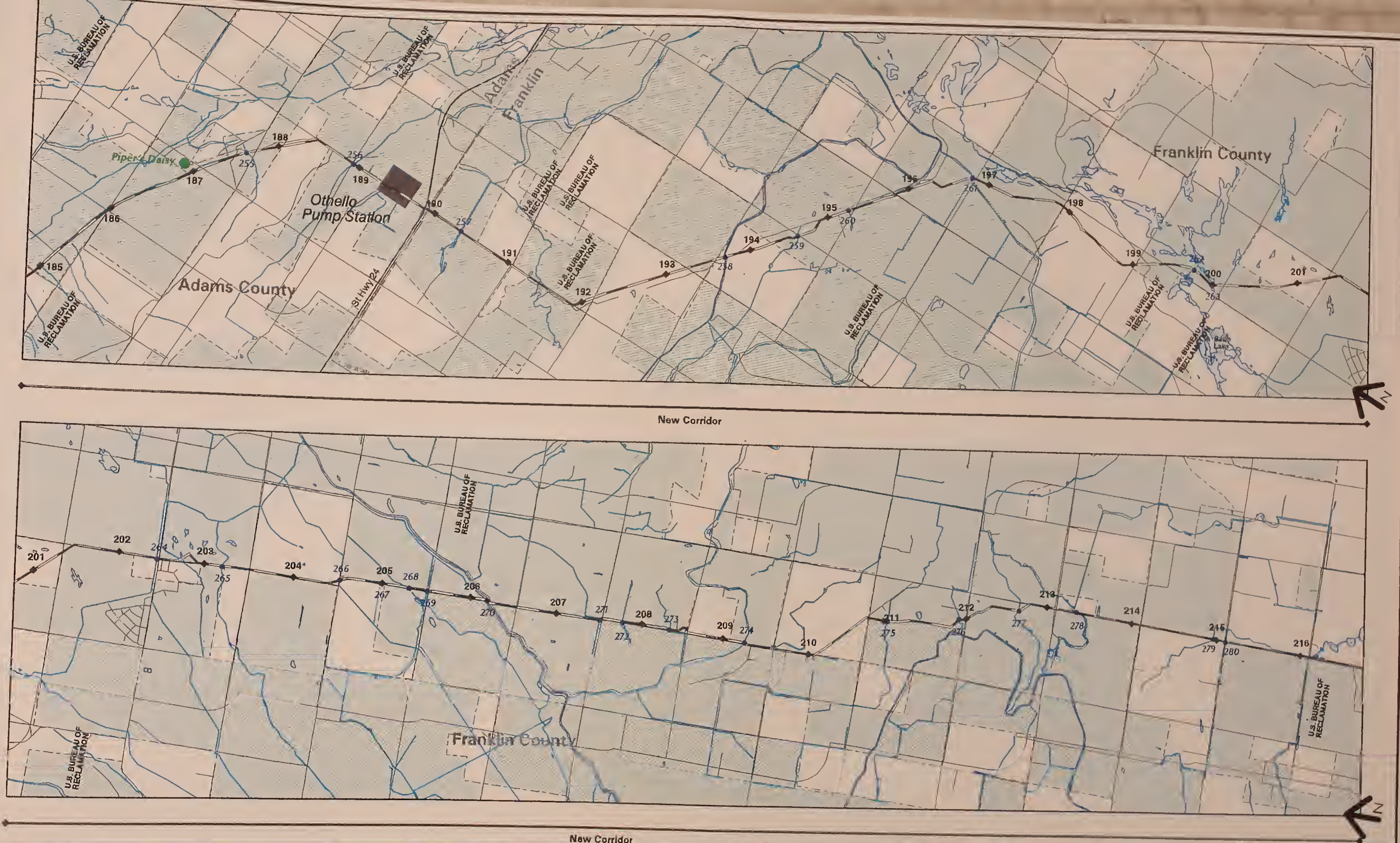
Figure 7

SOURCE: Dames & Moore, 1998

1 0 1 2 3
miles

1" = 5,280'

URCE:

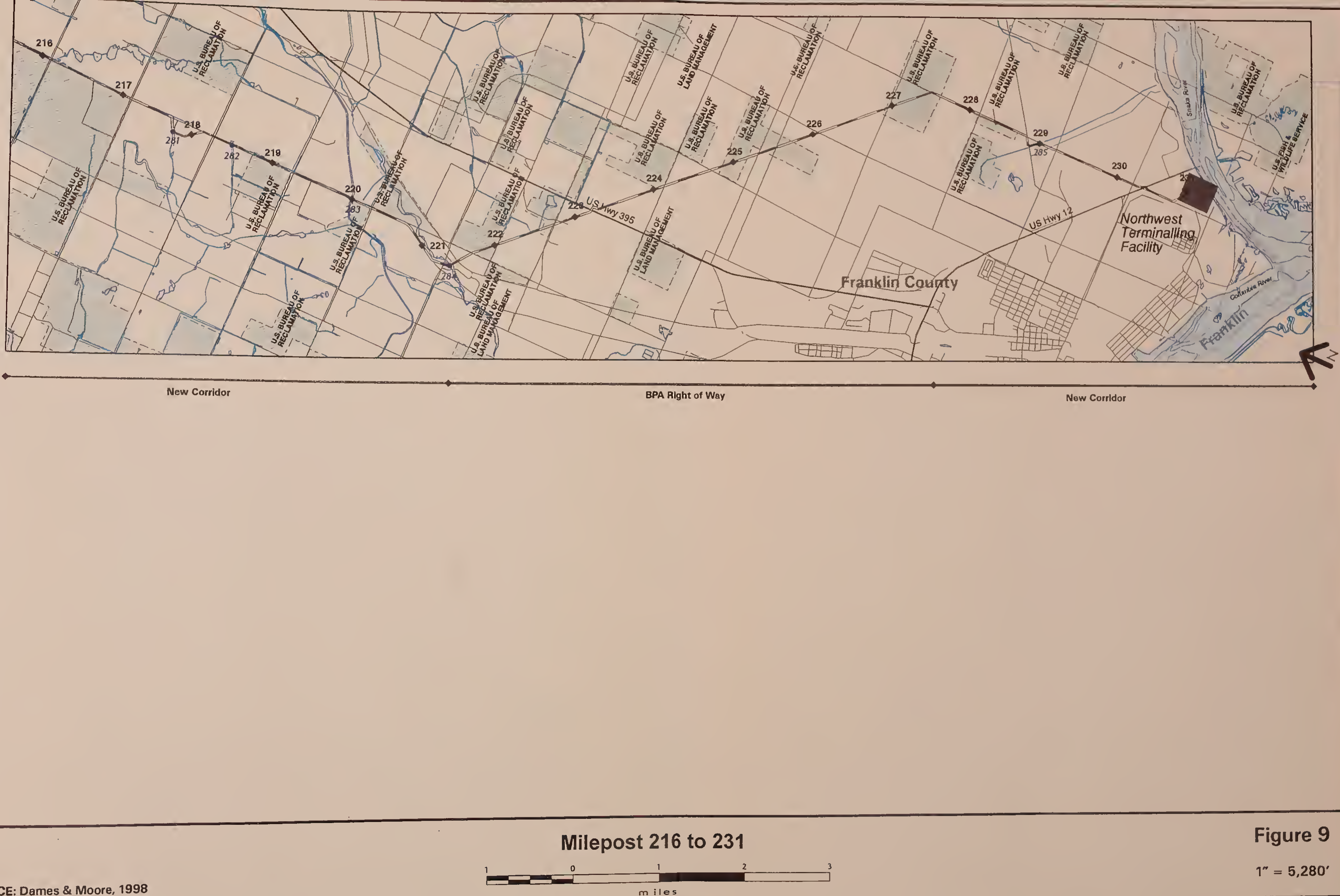


Milepost 185 to 216

Figure 8

1" = 5,280'

SOURCE: Dames & Moore, 1998



Milepost 216 to 231

Figure 9

1" = 5,280'

SOURCE: Dames & Moore, 1998

Metric Unit of Measure Conversions

When You Know the Number of . . .	Multiply by . . .	To Find the Number of . . .
inches	2.54	centimeters
inches	25.4	millimeters
feet	0.3048	meters
miles	1.6093	kilometers
square yards	0.8361	square meters
acres	0.4046	hectares
cubic yards	0.7645	cubic meters
pounds	0.4535	kilograms
short tons (2,000 pounds)	0.907	metric tons
degrees Fahrenheit	5/9 (after subtracting 32)	degrees Celsius